Does Architecture Design Matter in High Rise Residential Housing?
An Empirical Study in Hong Kong Residential Property Market

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A Thesis submitted in Partial Fulfillment
of The Requirements for the degree of
Master of Philosophy
in
Economics

August 2007

Abstract of thesis entitled:
Does architecture design matter in high rise residential housing?
An empirical Study in Hong Kong Residential Property Market
Submitted by MA Wai Yip
For the degree of Master of Philosophy in Economics
at The Chinese University of Hong Kong

Abstract

This paper introduces interior design variables into hedonic housing model. Those variables are usually neglected by researchers while estimating the fitted value of a dwelling. It is believed that most potential buyers in property market would consider the floor layout of a flat before making purchase decision. Only few studies, which always concentrate on low-rise apartments, analyze the relationship between housing design and the price. Since the architecture design of a housing estate is more or less the same, some analysts, in order to maximize the goodness of fit, use estate dummy in their models. Instead, we employ the idea of Nakata and Asami (2006) as well as the common descriptions in property market to construct the data set of the model. In Hong Kong, property agents always use some terms, for example shape of living room and the view of the flat, to descript the features of flat to potential buyers. Using the most frequent transaction housing estates in Hong Kong, and we show that some of the newly introduced variables, for instance, "No. of toilets", "Sea view", etc, carry explaining power to the price.

摘要

室內間隔是大部份住宅買家的其中一個考慮因素，但是絕大部份房地產經濟學家都忽略以上因素。本文嘗試把室內間隔引入房屋價格模型，並結合計量統計學的分析，研究室內間隔怎樣影響房屋價格。本文採用中田及紺野(2006)所提出的室內間隔細分法以及香港地產界所提出的室內間隔形容方法，來建本文之數據資料。研究結果顯示，多個新引入的因素，例如“廁所的數目”，“海景”等均有解釋房屋價格的能力。這些結果爲現時香港住宅樓宇的室內間隔設計提供了重要啓示。

Acknowledgments

I would like to take this opportunity to express my sincere gratitude to my supervisor, Prof. Zhang Jun, to whom I am deeply indebted. He has been exceptionally patient and responsible in the supervisions. During the whole year on preparation of this thesis, we meet once each week to discuss my progress. He is always willing to help me to overcome my difficulties. Thank you very much!

It is my pleasure to learn research attitude and skills from Prof. Charles Leung Ka Yui. His influence on me is surely beyond the scope of academic insight. Without his support, I don't think I can finish my dissertation and have a fruitful career in the real estate industry.

I would also like to thank my internal examiners, Prof. Chong Tai Leung and Prof. Du Julan for their insightful suggestions and invaluable advice. Their tolerance and encouragement during the course of research helped me to solve many problems. I have benefited a lot from their knowledge and talents.

I owe a great deal to my fellow classmates, Kelvin Wong, Hamton Wong and Derek Wong for their support and assistance.

Finally, in my endeavor to complete this dissertation, my family members as well as Miss Christina Li showed their love and care, which are something I can never forget.

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Chapter One

Introduction

It is believed that the interior design of a flat could influence its valuation,[1] since most potential buyers in real estate market would think about of these factors before making purchase decision; however, "interior design variables" are missing in most of hedonic pricing model.[2] In fact, even within the interior design profession, not much scientific research has been concluded on the price impact on design neither.[3]

Using architecture design variables to explain the price is not a new thing in real estate economics, and some researchers have showed these variables are essential to predict the price of houses. Asabere et al. (1989) find that there are any partial effects due to architecture on home value. Smith and Moorhouse (1993) have estimated a hedonic price index after considering the detailed design features of more than 3,500 row houses in Boston, and the style of housing is important in explaining the price of dwelling. However, it is

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[1] Smith and Moorhouse (1993) find that architectural styles and feature can explain the price differences of detached houses.

[2] For instance, see Leung, Wong and Cheung (2007) and the reference therein. For a survey, see Malpezzi (2003).

[3] *The practice of interior design is like the practice of medicine in two important ways: first, design begins with problem identification and diagnosis; and second, it develops a solution (in medicine, a "treatment") derived from an understanding of the specific context and needs. However interior design departs from medicine in one crucial way: it rarely conducts research to find out whether its "treatments" work.* Judith Heerwagen, in Interior Design: Handbook of Professional Practice, ed. by Cindy Coleman.

fair to say that architecture type variables are under-explored. And even few researchers introduce architecture design into high-rise apartments. There are several potential reasons why they prefer studying the design of detached or semi-detached houses. First of all, some may believe that apartments within housing estate are nearly homogeneous.[4] However, in term of floor plan features, flats selected from same housing estate can have a high degree of variety. For instance, Flat A has a foyer, whereas Flat B which is the neighbor of flat A does not have a foyer. Therefore, the degree of homogeneity of that is never conceivably high. Besides, many existing research are conducted with dataset from relatively rich countries, such as the United States, where detached housing is the norm. Even for Tokyo, Japan, where land is expensive, detached houses still constitute a large share of residential property. For some countries which depend on apartment buildings, such as China, Singapore, etc., data accessibility, transparency and reliability may create difficulties for "outside researchers". Moreover, it is not an easy task to quantify the characteristics of different interior layouts in the high-rise dwelling in the first place. As there are so many ways to describe the interior layout features in property market. In this paper, we employ the common descriptions used by

[4] See Ong (2006)

property agents in Hong Kong residential housing market.

There are, however, some recent efforts which attempt to break some new grounds. Nakata and Asami (2006) attempt using the site conditions to predict the floor layouts of detached houses in Tokyo. In their analysis, floor layouts of houses are transformed into "access graph" and "adjacency graph". Their model is based on the idea that, if the site conditions are similar, then the floor layout of houses may also be similar. We employ the idea of "access" and "adjacency" in Nakata and Asami (2006) paper; it is because this idea can help us to imagine the location of various rooms inside a flat. Having this idea is important, as we can analyze whether buyers have some special preference toward the interior arrangement of various rooms. For example, buyers may think it is more convenient that toilet is located near or adjacent to bedroom, or some buyers may not like there is a direct access from the kitchen to the living room. In this paper, we can analyze those quantitatively.

Besides, with the help of living room shape dummies and other layout features dummies, we can have a clear understanding about the floor plan of each transaction. Actually, some property agency firms also have this practice for the sake of having better record of the corresponding apartment. They only use simple descriptions, for instance, number of bedrooms, shape of living

room, etc, to let buyers to have some idea about the flat. However, they have never done as thoroughly as we do in this paper.

It is the first attempt to examine the buyers' preference toward different floor plan features in an Asian market, based on a large number of transactions in between the first quarter of 1992 to the fourth quarter of 2005. This paper uses the transaction data of thirty-three largest housing estates in Hong Kong, the reasons why we use large housing estates instead of small housing estates or detached houses are as follows. First, those estates are frequently traded, and therefore, the buyers do often have alternatives when making the decision. The transaction price is to a large extent reflecting all the housing attributes, including the interior layout of the flat. If we consider some housing estates from the less frequently transacted market, i.e. thin market, then the result of our model may be not accurate in the sense that some micro- attributes, for example, whether the apartment has been decorated or not, may be too significant. Second, the information about the floor plans of large housing estates is easily available, as property agency firms are always willing to provide such information to the potential buyers and walk-in housing seekers. A floor plan in architecture is a diagram of the relationships between rooms and other physical features at one level of a structure. It is similar to a map

that the orientation of the view is downward from above. People can have some understanding about the arrangement of various rooms inside the apartment after reading the floor plan provided by property agents. Therefore, floor plan is one of the Basic information for potential buyers in residential housing market. To analyze the implicit prices of different layout features, we construct a comprehensive set of variables according to the floor plan information.

The following chapter provides a literature review and description of the variables used. Expected sign of variables, data description and methodology are described in chapter 3, chapter 4 and chapter 5 respectively. The empirical findings and interpretations of these findings are presented in chapter 6. The limitations and future direction appear in chapter 7. A final chapter provides a conclusion.

Chapter Two

Literature Review

This paper also attempts to analyze the other factors that determine the dwelling value in the property market of Hong Kong. In a competitive housing market, buyers will pay according to the quality of the house. "View" should be one of the attributes to be considered. Darling (1973) and Brown and Pollakowski (1977) show that dwelling with sea view or lake view can be sold at a premium. Benson et al (1998) find that buyers in Bellingham, Washington are willing to pay more for a house with higher-quality ocean view. The size of data set in Benson's analysis is only seven thousand observations, which are all detached houses; therefore, they can easily measure the view at an accurate manner. Chau et al (2005) show that dwelling with sea view sold for approximately a 2.25% higher price, other attributes constant, than those with no sea view. We do consider "Sea view" as one of the desirable attributes; therefore, we try to obtain the view information by conducting a personal inspection of all housing estates in the sample in the summer 2006. Besides, we also use the satellite map as complementary reference. Actually, there is no formal definition of "Good-view" or "Bad-view". Different buyers may have different preference towards the same view. Therefore, we only consider the

dummy variable "Sea-view", and other views, for example, "Park-view", "Highway-view", etc. won't be considered in this paper. It is because there are so many different views and there are so many micro-factors in reality; we can't include all the possible categories in our paper. Moreover, given their view belong to same category; it is possible their views are different in reality. For example, there are two flats, i.e. Flat A and Flat B, having the view "Highway", it is possible that Flat A is free from noise pollution, as there exists the noise reducing feature in this portion of highway, whereas, Flat B residents suffer from noise pollution due to absence of that in this portion of highway. Therefore, for simplicity, we only consider "Sea-view" in this paper. "Water 500" is a dummy variable, which is employed by many previous researches,[5] to indicate whether the block of building is located within the sea by 500 meters.

Some researchers are interested in analyzing architecture design affecting the dwelling price.[6] Asabere et al. (1989) show that premium prices are associated with the historical architectural styles, for instance, colonial, federal, garrison, and Victorian. Smith and Moorhouse (1993) find that

[5] Leung et al (2002), Leung et al (2006) use "Water 500" as one of the variables indicating the location of the apartment.
[6] Vandell (1995) studies institutional factors perpetuating segregation in urban neighborhoods. He also considers the design and style of housing as one of the subset in the site characteristics.

architecture style and feature accounts for 14% of price differences of the house in Boston. Smith and Moorhouse (1993) paper focuses on nineteenth century American urban architectural form speculatively built row house and analyzes whether there exists a premium on the features which can be found in house, [7] not high-rise residential apartment. The findings of western researchers are based on the architectural style of detached houses; nevertheless, they don't concern the floor plan features as well as the arrangement of various rooms inside a house or apartment. Whereas, our paper focus on "interior features", instead of the architectural design of whole building, therefore, we can understand the preference of residents towards various floor plan features.

The locational arrangement of different rooms can be quantified into the concept of accessibility and adjacency. If kitchen is directly accessible to living room, then the flat is regarded as kitchen accessible to living room. If the kitchen is located just next to bedroom, then the flat is regarded as kitchen adjacent to bedroom. This model measures the implicit prices of floor layout attributes, which can be interpreted as the premium for desirable design features.[8]

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[7] Those features, for example, rusticated basement, bracketed hood, cupola, iron lintels, etc.

[8] For details, see appendix.

In Hong Kong residential market, market participants, for instance, property agents, housing developers, etc. always distinguish the living room into living room for dinning and living room for taking rest. Therefore, it is common to describe that, for example, there are two living rooms and shape of living room is "Rectangular". In this paper, we don't introduce the variable "No. of living room". It is because there is no formal definition and no clear segmentation between living room for dinning and living room for taking rest. Therefore, given the same floor plan, some property agents may demonstrate there are two living rooms, whereas some may think that there is only one living room. For the shape of living room, they can be categorized into four types, namely, "L-shape", "Rectangular", "Two-rectangle" and "Diamond". Diamond-shape living room is a special feature in local dwelling. The one of advantages of this shape is higher degree of privacy, as it is not possible to have inter-visibility with next flat.[9] However, due to non-rectangularity, it is quite difficult to place furniture without wasting some space. Actually, the architects recognize the potential problems associated from "diamond-shape living room"; therefore, the size of living room is generally larger. And

[9] For details, "Wo de jia" [videorecording] / jian zhi Gu Qihui ; bian dao Deng Minmei ; Xianggang jian zhu xue hui lian he zhi zuo. Xianggang : Xianggang dian tai dian shi bu, 1997. UC Local TV Programme. Call No.: NA1546.H66 C48 1997 vdcst.2

residents can place the special design furniture for the sake of maximizing the use of internal space.

We have considered using the size of living room and size of bedroom, which are continuous variables, so that we can construct a ratio between them. There is no previous literature mentioned about that ratio. We think that it is possible to have relationship between this ratio and the price of dwelling; furthermore, we may find the optimal ratio so as to maximize the transaction value of apartment. However, there is no such kind of information available; property agency firms never provide this piece of information, which may be so technical, to potential buyers. To overcome this constraint, we intend to use "No. of bedrooms" and "No. of toilets" to let us to have better understanding to the interior layout of the sampled apartments.

Although residents have the freedom to modify the floor plan of their home,[10] for example, to reduce the number of bedrooms by demolishing the wall between two bedrooms, they always need to incur cost to do so. It is believed that residential property buyers who have children prefer to purchase the flat with more bedrooms and more toilets. Therefore, I attempt to consider the number of bedrooms and number of toilets in the data set. For other floor

[10] In Hong Kong, residents need not to have government permission before adjusting the number of bedrooms in their flats.

layout features, e.g. foyer,[11] corridor[12] and balcony,[13] are also included in my analysis. There is no previous research studying the implicit prices of various floor layout characteristics, therefore, we can't have such literature findings and experience from ancestor for our reference directly.

Distance from Central Business District is one of the important variables influencing the value of dwelling.[14] Distance decay mechanism[15] suggests that the land value or land rent decreases[16] while increasing distance from the city center, in which the economic activities is highly concentrated and land supply in CBD is limited. Moreover, the accessibility is decreasing while increasing the distance from CBD. In reality, there are fewer means of transport in the fringe of city. The relationship between the land rent or land value and the distance from the city center can be at least traced back to the work of Ricardo, which is then extended to form the rent gradient literature.[17]

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[11] Foyer is a space in a flat which is used for entry from the outside. http://en.wikipedia.org/wiki/Foyer.

[12] Corridor is a path or guided way which is usually referring to an interior passageway in modern building. http://en.wikipedia.org/wiki/Corridor.

[13] Balcony is a kind of platform projecting from the wall of a building, supported by columns or console brackets. http://en.wikipedia.org/wiki/Balcony.

[14] In Hong Kong, C.B.D. refers to Central and Tsim Sha Tsui.

[15] Von Thunen hypothesized concentric rings of land use around an isolated populated center in 1826. The theory stresses the primacy of transportation cost in determining land value and use.

[16] See David Ricardo (1817), *Principles of Political Economy and Taxation*

[17] Obviously, it is beyond the scope of this paper to review that literature. Among others, see DiPasquale and Wheaton (1996), Betraud and Malpezzi (2003). Among others, Hanushek and Yilmaz (2007a, b) provide a general equailibrium formulation which will generate a rent gradient endogenously, among other stylized facts found in the public finance and urban economics literature.

Daniel A (1979), Ronald L. et al. (1987), Archer, W. R (1996), Geoghegan et al. (1997) and Soren T. et al. (2006) show that there is a negative relationship between dwelling value and the distance form CBD. Mok et al. (1995) find that distance decay mechanism appears in Hong Kong residential property market. We also intend to test whether this mechanism still exists in Hong Kong residential housing market, after other explanatory variables are taken into consideration.

Clearly, the remote districts are greatly benefited from the development of the railway system. In Hong Kong, there are two major mass transit systems, namely, Mass Transit Railway (MTR)[18] which corresponds to the subway in the U.S. and Kowloon-Canton Railway (KCR)[19] which corresponds to train in the U.S. Having the linkage of railway, the accessibility is better. Grass (1992), Bowes and Ihlanfeldt (2001) show proximity to railway station is one of the desirable factors for both high income and low income residential neighborhoods. Many researches studying local residential market show that

[18] MTR provides metro service on northern part of Hong Kong Island, Kowloon Peninsula, and southern part of the New Territories as well as the Hong Kong International airport. http://www.mtr.com.hk/prehome/index.html for detail.

[19] KCR operates four train lines, namely, East rail (connecting Lo Wu to East Tsim Sha Tsui), Ma On Shan Rail (connecting Wu Kai Sha to Tai Wai), West Rail connecting Tuen Mun to Nam Cheong) and Light Rail (serving the northwest New Territories). www.kcrc.com for detail.

the linkage with mass transportation system is a desirable attribute.[20] Both MTR and KCR have several lines, some researchers[21] prefer using dummy variables to represent which line the housing estate is located on. For instance, Mei Foo Sun Chuen is located along MTR Tsuen Wan line; Tai Koo Shing is located along MTR Island line, etc. However, we don't think it is appropriate to follow this method to indicate the locational attributes of specific housing estate, as our sample is concentrated on the privately developed large scale and frequently transacted housing estates only. Therefore, there are so many sampled housing estates located along same line, on the other hand, it is possible that there is no observation located along some lines, i.e., we don't have any observation on MTR Tseung Kwan O line. Most of the observations belong to same category,[22] thus, the results of the model may not reflect the reality if we apply this classification.

Presence of clubhouse[23] can add value to the property, as clubhouses sometimes provide comprehensive facilities, for example, swimming pool,

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[20] Mok et al. (1995), Leung et al. (2002), Tse (2002) etc. find the coefficient of the MTR or KCR is always positively significant.

[21] For example, Leung et al (2006) use dummy variables "KCR_E", "KCR_W" and "KCR_MOS" to represent KCR East Rail, KCR West Rail and KCR Ma On Shan Rail respectively.

[22] In our sample, given the housing estate is linked by MTR network; it belongs to MTR Island line category.

[23] This information is obtained from the websites of Midland holdings Limited and Centaline Limited, both of which are major real estate realtors in Hong Kong.

tennis courts etc, for recreational purpoes. Tse (2002)[24] and Leung et al. (2002) using Hong Kong housing data shows that availability of clubhouse can add value to the apartment. Therefore, the expected sign of coefficient is positive. However, operating a clubhouse always adds burden on the budget of property management; residents need to pay extra amount management fee for having it. Therefore, the effect of clubhouse may not be certain.

Proximity of urban park, or open space can also influence the valuation of dwelling. Do and Grudnitski (1995); Soren and Sarah (2006) find that the effect of proximity to open space[25] on home sales price is positive. Dehring and Dunse (2006) find flat prices increase with additional proximity to public recreational open space and unravel some factors, for instance, whether the house is located near the central business district or not, determining the amenity value of open space in urban housing markets in Aberdeen, Scotland. Mahan et al (2000) study the value of wetland amenities in the Portland, Oregon, metropolitan area using hedonic price model. They find that reducing the distance to the nearest wetland by 1000 feet will lead to an increase in home value by US$ 436. Since there are more than eight hundred and fifty

[24] Tse (2002) shows that clubhouse adds HK$0.305 to price per square foot relative to a similar house without clubhouse.
[25] Open space includes neighborhood parks, greenbelts, country parks and golf courses. Do and Grudnitski (1995) find that the premium paid for the properties on Golf course is approximately 7.6%.

buildings in our sample, it is not possible for us to measure the distance to open space for each building in an accurate manner. Instead, we prefer to employ the efficient alternative, which is a dummy variable called "Open Space 500", to indicate whether the apartment is located within the nearest open space by 500 meters.

Many researchers studied the effect of Chinese preferences toward lucky number, and the results showed that lucky number is also a desirable attributes. Bourassa and Peng (1999) show there is a premium for the housing with lucky number in the society with high percentage of Chinese in New Zealand. On the other hand, Leung et al (2006, 2007) do not confirm this finding in Hong Kong.[26] In this paper, the "Lucky number" is included as one of the variables, taking other variables such as "Sea views" and interior design into consideration.

This paper considers more thoroughly than most previous paper. "Net ratio" is always neglected by researchers but it is frequently inquired by housing buyers.[27] Only Tse (2002) shows that one percentage point increase in "Net ratio" leads to HK$1.605 rise in price per square foot, other

[26] According to their findings, only less than 10% of "Lucky number" estimated coefficients are positively significant at 5% level.
[27] EPRC does not supply efficiency ratio before 1996. This piece of information is available afterward.

characteristics being constant. However, he uses only six private housing estates in Tsuen Wan, where is a district located in South New Territories and the data set only includes 1000 transactions recorded in 1994, it is a very small scale analysis in real estate economics, therefore, the validity of the result may not be held in overall situation of Hong Kong residential market.

Chapter Three

Expected Sign of variables

As the maintenance cost and the age of the property are positively related, negative coefficient of age is expected. Buyers in residential property always price more for the flat on higher floor, as those apartments would have better view as well as free from noise pollution. Therefore, the expected sign of floor is positive. In order to capture the non-linear effect, the squared term of these variables are also added into the model.

The coefficient of net ratio is expected to be positive, as this ratio indicates the actual percentage of usable area inside the apartment. In Hong Kong, some housing estates, for example, Golden Lion Garden, have a bad reputation due to the low net ratio. Clubhouse provides a lot of facilities for the estate residents; on the other hand, presence of clubhouse may insert the pressure of increase in management fee. Therefore, the expected sign of its coefficient is not certain. Many previous researches using local residential data show that lucky number is not always significant,[28] however, in order to capture the potential explanatory power of Chinese superstitious belief, lucky number is included in this analysis.

[28] For example, Leung et al. (2006) show that only less than 4% cross-sectional hedonic model indicates lucky number being positively significant.

Mok et al. (1995) introduce a dummy variable called "Big estate" which indicates whether the apartment belongs to large housing estate or not. This dummy variable is not applicable in our research, as there is not formal definition of "big estate" and all the transactions in our data set belongs to large-scale residential housing estate. This paper uses estate scale, which count the total number of apartments in certain housing estate, in order to capture the explanatory power of liquidity. It is easy for a flat-seeker to buy an apartment in a large housing estate, as there are always lots of flats available for sale in these estates. The possibility of having a successful match is high, so the turnover of large housing estate is higher than that of small housing estate. Therefore, the scale of housing estate department can approximate the degree of housing liquidity.

The transportation network in Hong Kong is quite good in the sense that residents' commuting journey from home to working place, for example, in CBD, is usually less than an hour, however, the convenience of transport system can only reduce the psychological distance, that is the people's perception toward the distance travel, and the variable "Distance from CBD" is expected negative, because transport cost increases with the distance travel. Residents have to pay more for their commuting journey, if they live in the

housing estate far away from city centre.

Compared with the New Territories, Hong Kong Island and Kowloon Peninsula have relatively limited supply in land for residential use; therefore, both of their estimated coefficients are expected to be positive. The variable "Open space 500" is expected to be positive, as those residents can access the area for leisure within 500 meters from their home. Air quality and micro-climate are better if there is an extensive land of greenery near the place to live.

For the floor layout attributes, the usage of foyer, corridor and balcony is limited; therefore, it is expected to have negative signs. Kitchen adjacent to bedroom is not good, as it should not be desirable for the hygienic consideration if a place for cooking is located near a place for sleeping. Many people complain it is quite difficult to place furniture in diamond-shape living, which is non-rectangular or sometimes pentagram, since some living room space would be wasted. However, the correlation coefficient between "Diamond" and "Gross Size" is near 0.4, this means it is a positively correlation between these two variables. Having a larger living room can, to a certain extent, overcome the problem associated from "Diamond". Moreover, for the privacy consideration, "Diamond" category is better than other living room types, since the orientation of living room is the same as that of the

neighbor. Thus, the expected sign of variable "Diamond" is not certain.

If the flat has a roof, which is the top covering of a building, or a deck, which is an outdoor area connected to the flat, then the flat price is expectedly higher. Roof and deck can be used in a number of ways, for instance, garden landscaping, storing stuff, placing drying rack, etc. However, under the existence regulations, residents can not use the roof or deck to extend living areas of the flat.

It is the fact that residents can modify the floor plan in order to have an additional bedroom without the need of government permission, however, the number of bedrooms from the original floor plan may still indicate the preference of potential buyers in residential housing market. I believe more bedroom is more preferable to some buyers, therefore, the coefficient sign is expected to be positive. On the other hand, it is always costly to construct an extra toilet in an apartment, so the coefficient of number of toilet is expected to be positive.

For the view variables, sea-view is expected the most preferred among others, as it is generally believed that property with sea-view can give high utility to occupants. Therefore, the "Sea-view" is expected positively significant.

Chapter Four

Data Description

The data set is employed from Economic Property Research Center (EPRC).[29]The merit of the data set is that the details of each transaction, for example, the transaction price, the corresponding gross square-footage, floor, year-built, etc. are provided. However, the data base does not contain all the information we desire to have, the data set does not include the floor plan information as well as the specific view of each transaction, therefore, and supplementary references are needed for the sake of completing the data set.

To acquire the data of floor layout, we collected all the floor plans of thirty three housing estates which are included in my data set from the property agent firms.[30] The number of buildings for each housing estates range from 5 to 99 blocks and each building has 4 to 8 units. Since the variation of floor layout features can be very large, we have to study all of the floor plans in order to record all the variables.

(Table 1 about here)

To obtain the view of the apartment at an accurate manner, we read the

[29] EPRC, a subsidiary of the Hong Kong Economic Times, purchases all property market transaction records from Hong Kong Land Registry Department. Then the EPRC re-organizes those records and sell them to commercial and educational users. EPRC data base contains information of transaction price, corresponding gross and net size, as well as the address of it.
[30] For instance, Centaline, Midland, Ricacorp etc.

satellite map and make site investigations, as it is possible for the estate far away from the sea to have sea view when it is located on elevated land.[31] Besides, "Distance from CBD" is acquired from measuring distance of the shortest link, instead of the actual distance, between the housing estate and CBD. It is because there may be presence of natural barriers, for instance, a hill, a gulf etc, between the two points, therefore, it is more appropriate to use map reading skills to obtain this piece of information.

Dummy variables are used to deal with discontinuous factors in an effort to represent whether the feature or housing attribute is available. "Open Space500", "Water 500", "MTR500" and "KCR500" which are dummies can only be obtained from similar map reading technique. Moreover, we visit the website of some property agent firm in order to obtain the information of presence of clubhouse and the estate scale. To obtain the information of "Roof" and "Deck", we need to study the remarks of the floor plan. If there is no such remarks on the floor plan, we need to consult the property agents in corresponding district.

(Table 2, Table 3a, Table 3b and Table 3c about here)

The sample period starts from the first quarter of 1992 to the fourth

[31] For example, Allways Garden in Tsuen Wan is far away from the sea, but some flats in some blocks can have sea-view also.

quarter of 2005. We split the sample into 56 sub-samples according to the time of transaction, and there are at least more than 1400 transactions in each sub-sample. There are thirty-three residential estates representing more than two hundred thousand transactions. All of the observations in this paper belong to high-rise property category; there is no detached house or low-rise property in the data set,[32] as the buyers in this market may have different preference towards floor layout features and other housing attributes. To avoid double-counting, only the transactions with official housing sale and purchase agreement are considered in this analysis.

[32] Ong (2006) uses both high-rise and low-rise properties to analyze the foreclosure risk in Singapore.

Chapter Five

Methodology

Houses are heterogeneous goods that include a set of observed attributes; therefore, every housing unit is unique. To estimate the value of houses, this paper employs the theory of hedonic price analysis which was introduced by Court (1939) and had been improved by Rosen's (1974) theoretical finding. This approach is used to estimate the marginal implicit prices of a vector of independent variables to identify buyers' willingness to pay.

5.1 Ordinary Least Square

Hedonic model represents a competitive equilibrium condition that many buyers and sellers are involved. Both groups value the flat according to the observed characteristics, for example, seller tends to set a premium to the price of apartment with sea-view; buyer tends to request a discount if the flat has some undesirable traits. In short, the coefficients of variables obtained by regressing housing prices are interpreted as buyers' implicit prices to those housing attributes.

To avoid the time aggregation bias,[33] we split the full sample into 56 sub-samples on a quarter basis. As the implicit prices of housing attributes are

[33] See Malpezzi (2002).

not stable overtime,[34] it is not appropriate to use one hedonic equation to estimate the parameters. For each quarter, a semi-log specification is estimated in the following form:

$P_i = e^{\beta_{i0}+\beta_{i1}S+\beta_{i2}N+\beta_{i3}L+\beta_{i4}F+\beta_{i5}V+\varepsilon_i}$, so that

$$\ln(P_i) = \beta_{i0} + \beta_{i1}S + \beta_{i2}N + \beta_{i3}L + \beta_{i4}F + \beta_{i5}V + \varepsilon_i \quad , i = 0, 1, 2\ldots, 56 \qquad (1)$$

, where P represents the transaction price of apartment, S represents structural attributes (such as age of the building), N represents neighborhood attributes (such as proximity to MTR station), L stands for locational attributes (such as distance from CBD or the district where the estate is located), F represents floor layout attributes (such as foyer, corridor, balcony), V represents view attributes (such as road view, open space view, etc,), and ε represents the error term in the regression model.

[34] Leung et al. (2006) show that the implicit prices of housing attributes are not constant overtime.

Chapter Six

Empirical result

The following results come from a series of cross-sectional hedonic price regression. In each quarter, we estimate several set of implicit prices and we have 56 sub-period hedonic models totally. We calculate the percentage of each variable significance at 5% level, if an independent variable, for example, "Floor" appears positively significant at 5% level in 52 sub-period hedonic price equations, therefore, it will be presented as there are 92.86% "Floor" estimated coefficients are positively significant at 5% level. "The results are presented in Table 4a, Table 4b and Table 4c. Actually, it is easy to achieve high level of R-square and adjusted R-square using hedonic price model in real estate economics, however, omitted variable bias may arise in some previous researches,[35] therefore, it is advisable to introduce and include some relevant explanatory variables into the model.

(Table 4a, Table 4b and Table 4c about here)

6.1. Basic model 1

In Basic model 1, which only includes general regressors in hedonic

[35] Tse (2002) has neglected lots of important variables, for example, the scale of housing estate, interior layout variables. However, the signs of coefficients are expected, as this research only focuses on few housing estates in the same district, therefore, it is possible to assume some set of variables as the same. If the sampling estates are located in different districts, it is not appropriate to have this assumption.

price model, especially the analysis is done by western researchers. The average R-square and adjusted R-square are as high as 81%, however, some coefficients appear strange sign, for example, the estimated coefficients of "Age" are always positively significant at 5% levels and all "Age2" coefficients are negatively significant at 5% level. This result is not reasonable. It is because there is a positive relationship between age of building and rate of depreciation. Residents living in old building need to incur higher maintenance cost, therefore, we are convinced that there are some important variables missing in Basic model 1.

6.2. Basic model 2

In Basic model 2, which includes more explanatory variables, for example, "Net ratio", "Distance from CBD", "Distance from CBD 2", "Estate Scale" and "Sea-view". Those variables are not common in local real estate researches. It is not easy to get the data of "Net ratio", as most of the data base, for instance, EPRC data base, do not have a comprehensive set of this information.[36] Besides, some local researchers believe that Hong Kong is a small city in which resident can always have a short travel time for commuting journey, therefore, they didn't introduce "Distance from CBD" into their

[36] EPRC only provides this piece of information since 1997, for the transaction before 1997, we need to find the address of this transaction and then fill in this piece of information.

model. Moreover, "Estate Scale", which measures the number of apartment units in a housing estate, is initially introduced in this paper, as we believe buyers in residential housing market consider this factor while making purchase decision. Furthermore, EPRC does not provide the "View" information of corresponding apartment; therefore, not all previous researches include this kind of factors. "Sea-view" is also considered in Basic model 2.

This set of factors can improve the explaining power of model and make the sign of coefficient to be expected. Average R-square and adjusted R-square in this model are 86.6% and 86.5% respectively, those new variables have more than 5% additional contribution to "goodness of fit".

Moreover, the estimated coefficients of "Age" and "Age 2" are always negatively significant at 5% level; this result is more reasonable and understandable. We use the average value of estimated coefficients from this model and Basic Model 1 to plot a figure. We can see that the implicit prices of "Age" decreases at an increasing rate in Basic model 2, whereas the implicit prices of "Age" increases at a decreasing rate in Basic model 1. The increasing portion of the curve (Basic model 1) happens while apartment's age is in-between 0 and 14. The diminishing appears when the apartment is older than 14-year-old.

(Figure 1 about here)

Near all estimated coefficients of "Net ratio" are positively significant at 5% level in Basic model 2, this reflects buyers are willing to pay more for the apartment with higher "Net ratio". On average, one percentage increase in the "Net ratio" will lead to 1.18% increase in transaction price of this apartment, ceteris paribus.

(Table 4d, Table 4e, Table 4f and Table 4g about here)

All "Distance from CBD" coefficients are negatively significant at 5% level, and its squared-term's coefficients are often insignificant at 5% level. The result confirms the phenomenon of "Distance Decay Mechanism" appears in Hong Kong residential property market. On average, one kilometer far away from the CBD will lead to reduce the transaction price of that dwelling by 2%, holding others housing attributes constant.

Near 70% "Estate Scale" estimated coefficients are positively significant at 5% level; this result reflects our postulate is correct. Other housing attributes being constant, the apartment which belongs to a 5000-unit housing estate will be valued 1.02% more than the apartment from 3000-unit housing estate. It may be because it is easier to liquidate the flat of larger housing estate. We do not have a reason more convincing than liquidity to

interpret our findings, as there is no empirical finding on how the estate-scale influencing the dwelling valuation or influencing the time on the market. Besides liquidity consideration, it is the fact that residents living in larger housing estates may be benefited from economies of scale, for example, the average repair cost of building can be lower in larger housing estate, as they can have higher bargaining power while dealing with maintenance companies.

Sea-view is initially introduced in the "Basic model 2". Near 100% of its estimated coefficients are positively significant at 5% level, This is consistent with the previous research findings and the general belief that "Sea-view" is preferred to other views. On average, the apartment with "Sea-view" can be transacted 8.2% higher than the apartment without "Sea-view", ceteris paribus.

6.3. Comparison between Basic model 1 & Basic model 2

Comparing the Basic model 1 and Basic model 2, we find that the percentage of positively significantly of MTR500's estimated coefficients increases from 46% to 100%. According to the result in Basic model 2, the apartment located near MTR station can be transacted at 10% more than those far away from the access of MTR linkage. For the variable "KCR500", all of its estimated coefficients are positively significant at 5% level in Basic model

1, and almost all of its coefficients do so in Basic model 2. Comparing the findings of these two models, the premium of "KCR500", on average, is lower in Basic model 2, which is only 13%; however, in Basic model 1, the value on average is as high as 27%. This reflects that there are lots of variables being neglected in Basic model 1; therefore, the coefficients' value of existing variables may be inflated.

For the variable "Open Space 500", more than 70% of its coefficients are negatively significant at 5% level in Basic model 1; however, after we introduce some variables, near all of its coefficients become positively significant at 5% level. The sign of its coefficients is more reasonable in Basic model 2, as residents can have better environment and can be easily accessible to the place for leisure if they are living near the open space. For the variable "Water 500", all of its coefficients are positively significant at 5% level in Basic model 1; however, more than 70% of its coefficients are negatively significant at 5% level in Basic model 2. It may be due to the undesirable micro-climatic condition of coastal area. It is the fact that there is a positive relationship between the relative humidity and the distance from the sea, therefore, the depreciation rate of furniture and electrical appliances may be faster. Therefore, residents discount the price of flat too near the sea.

Furthermore, the specification form of "Basic model 2" includes "Sea-view", who's estimated coefficients are always positively significant at 5% level, and almost all observations with "Sea-view" belong to "Water 500", therefore, the positive effect of "Water 500" may be fully captured by "Sea-view", in other words, it may not be a good idea to live near coastal area without "Sea-view".

In Basic model 1, all of the "Kowloon" coefficients are positively significant at 5% level, whereas 80% estimated coefficients are positively significant at 5% level in Basic model 2. Therefore, those additional variables, for example, "Distance from CBD", introduced in Basic model 2 can reduce the percentage of positive significance of "Kowloon", given the controlled variable of "New Territories". Actually, if many districts in the New Territories, for instance, Tsuen Wan, Sha Tin, etc, are linked by mass transportation system, which can reduce the physiological distance of the commuting journey, therefore, the accessibility of those housing estates in the New Territories are as good as that of housing estates in Kowloon.

6.4. Model with "Design Variables"

We introduce another set of explanatory variables into hedonic model; those variables belong to the category of interior design. The third column shown in table 4 indicates the result of this model. The average R-square and

adjusted R-square in "Model with Design variables" are 87.1% and 86.9% respectively. Comparing with the result of Basic model 2, the percentage of significance of each variable is nearly the same, except "Lucky number" and "Kowloon". Only 12.5% of "Lucky number" estimated coefficients are positively significant at 5% level in Basic model 2, however, in the model with "Design variables", more than 23% of its coefficients are positively significant at 5% level. This variable becomes more important if we add the new set of regressor into the model. On the other hand, the importance of "Kowloon" reduces. Only less than 60% of "Kowloon" regressors are positively significant at 5% level.

For the design variables, about 44.6% of "Foyer" coefficients are negatively significant and 53.6% of its coefficients are insignificant at 5% level. The result reflects that, generally, the buyers in housing market price the flat with foyer lower than the flat without foyer. It may be because the foyer can only be placed a cabinet to store shoes. On the other hand, near 45% of "Balcony" coefficients are negatively significant at 5% level. This is consistent with our expectation, as "Balcony" should be a luxurious housing feature. The housing estates included in this sample are not the luxurious housing category; therefore, those buyers may have negative valuation toward

this feature. Besides, the size of balcony is included in the gross size, and it is believed that the usefulness of balcony is lower than other parts inside an apartment. Actually, we also want to analyze the per-square foot price of balcony, but we don't have the information about the size of balcony and it is so complicated to measure the size of balcony from the floor plan because we need to process two hundred thousand of observations and more than seventeen thousand of floor plans.

Near 90% of "No. of Toilet" coefficients are negatively significant at 5% level. On average, the additional toilet reduces 4% of the transaction price of housing. The buyers may believe that the usefulness of the additional toilet is low; therefore, they would like to discount the apartment with two or more toilets. Near 40% coefficients of the variable "Kitchen adjacent to bedrooms" are negatively significant at 5% level. The interior feature is not good, as the soot from kitchen may dirty the bedrooms easily. And this feature reduces the transaction price by 2.2% on average, ceteris paribus.

For the shape of living room, we use "Two-rectangle" as controlled variable, we analyze whether buyers have special preference toward various shape of living room. Only 32% of "Diamond", less than 40% of "L-shape" and less than 10% of "Rectangular" estimated coefficients are positively

significant at 5% level. Their estimated coefficients are always insignificant at 5% level. Therefore, buyers may not value certain living room shape more.

For "Roof" and "Deck", their estimated coefficients are often positively significant at 5% level, i.e. more than 60% of their coefficients in quarterly hedonic price models. Generally, presence of roof can add 5%, on average, to the transaction price of dwelling, whereas, "Deck" can nearly add 13.5% to the transaction price of the apartment on average. It is because the area of "Deck" or "Roof" are not included in the "Gross size", having these features can add value of the apartment. Buyers are willing to pay a premium to those housing features as they can use the "Deck" or "Roof" for leisure and recreational purposes.

6.5. Model using "restricted sample"

We construct a restricted sample for robustness check. We drop the observations which are suspected to be outliers. In some cases, there may be a close relationship between buyer and seller; therefore, it is possible that the transaction price is far below the fair value of the apartment. Since the data provided by EPRC does not include the detailed personal information of buyer and seller, it is not possible to trace all of the transactions for the sake of removing such observations. To deal with this problem, we decide to drop the

transactions whose square-feet price is lower than HK$500. We call the sample after considering the problem of "outliers" as "Model using restricted sample". The result of this model is shown in the fourth column of table 4. The total number of observations satisfied with this criterion is only less than 600, which is just a very small proportion of our whole sample. (Recall the size of the whole sample is more than two hundred thousand observations)

Compared with "Model with Design variables", which uses the same specification form as "Model using restricted sample", the average R-square and adjusted R-square can be improved more than 2%. The signs of variables' estimated coefficients are expected and many of them become significant in more sub-sample models, for example, more than 48% of estimated coefficients of "Foyer" and "Balcony" are negatively significant at 5% level in the "Model using restricted sample", recalling that only 44% "Foyer" and "Balcony" coefficients are negatively significant at 5% level in the "Model with Design variables".

6.6. Model with "Interactive terms and design"

We try several sets of interactive terms in order to analyze how the living room shapes affect the buyers' preferences. The interactive terms which are related to the shape of living rooms and some continuous variables are

introduced into the hedonic model. Since living room shapes are categorized into "Diamond", "L-shape", "Rectangular-shape" and "Two-Rectangle", there are four set of interactive terms shown as table 5.[37]

(Table 5 about here)

The results of interactive terms can be interpreted as followings:

$$\ln(Price) = \beta_0 + \beta_N NetRatio + \beta_L L + \beta Rec + \beta_D Diamond + \beta_{NL}(NetRatio*L) + \beta_{NR}(NetRatio*Rec) + \beta_{ND}(NetRatio*Diamond) + \ldots\ldots + \varepsilon \quad (2)$$

$$\therefore \frac{\partial \ln(Price)}{\partial NetRatio} = \beta_N + \beta_{NL}(NetRatio*L) + \beta_{NR}(NetRatio*Rec) + \beta_{ND}(NetRatio*Dian$$

Given living room shape is "Diamond", therefore,

$$\Rightarrow \frac{\partial \ln(Price)}{\partial NetRatio} = \beta_N + \beta_{ND} = 2.05 - 1.74$$
$$\Rightarrow \frac{\partial \ln(Price)}{\partial NetRatio} = \underline{\underline{0.31}} \quad (3)$$

Not all of the interactive terms are always significant, and the result of this model is shown in the fifth column of table 4. Most of "Net Ratio & Diamond", "Distance from CBD & Diamond", "Net Ratio & L-shape", "Distance from CBD & L-shape" and "Net Ratio & Rectangular" estimated coefficients are negatively significant at 5% levels. More than 50% of "Estate Scale & Diamond" and "Estate Scale & L-shape" estimated coefficients are positively significant at 5% level. Comparing with the "Model with Design variables", the shape of living room this model becomes more important.

[37] To avoid the problem of multi-collinearity problem, interactive terms related to "Two-rectangle" are controlled.

More than 80% of "Diamond" and "L-shape" coefficients are positively significant at 5% level, and near 70% of "Rectangular" coefficients are positively significant at 5% level, the control variable is also "Two-rectangle". Compared with "Two-rectangle" living room flat, other living room categories can be always transacted at a higher price, all other housing attributes being constant.

To compare the results, given it is a "Diamond" shape living room, one percentage point increase in "Net Ratio" will lead to only 0.31 percent increase in transaction price on average. The proportion is lowest among the three living room types shown in the model. For "L-shape" living room category and "Rectangular" shape, one percentage increase in "Net Ratio" will lead to 0.82 and 1.16 percent increase in price of apartment, respectively, on average. It may be because residents of "Diamond" type apartment have to sacrifice some spaces, it may be more indifferent for them to have higher "Net Ratio". On the other hand, it is easier to place furniture in "L-shape" and "Rectangular-shape" living room, therefore, the effect of change in "Net Ratio" will be more significant.

Given the apartment belongs to "Diamond" living room type, increase one kilometer from CBD will lead to more than 3.35 percent drop in traded

price. If the apartment belongs to "L-shape" category, one kilometer increase in "Distance from CBD" will lead to 2.77 percent drop in transaction price of dwelling. Therefore, the "Diamond" apartment is less resistant to distance decay, compared with "L-shape" and "Two-rectangle" shape. In reality, the average per square-feet price of South Horizons, which is a large housing estate located near CBD and provides only the apartment with "Diamond" shape living room, is double more than that of Kingswood Villas, which is also a large housing estate located far away from CBD and provides only the apartment with "Diamond" shape living room. Therefore, the finding is describing the fact.

The effect of "Estate Scale" is important for "Diamond" and "L-shape" category apartment. Given the apartment belongs to the type of "Diamond" shape living room, additional one thousand housing-unit increase in the estate development will lead to 1.08% rise in transaction price of the apartment, other housing attributes being constant. On the other hand, this interactive effect in "L-shape" category is less intensified, an extra one thousand housing-unit increase in the estate development will only lead to 0.78% rise in transaction value of the apartment, other factors holding constant.

6.7. Model with "Interactive terms and design" using restricted sample

Finally, we use the restricted sample, which excludes the possible outliers, for robustness checking the results of the "Model with interactive terms and design". The sixth column of table 4 shows the results of "Model with interactive terms and design using restricted sample". In term of sign of coefficients as well as the degree of significant, this model indicates similar results as that of the model using full sample. Compared with the results from "Model with Interactive terms and design", number of positively significant periods increase in the same specification form but using restricted sample. For instance, the shapes of living room's estimated coefficients, i.e. "Diamond", "L-shape" and "Rectangular" always appear positively significant at 5% level. Model using restricted sample can achieve a high level of average R-square and adjusted R-square, i.e. 89.9% and 89.7% respectively, comparing with these in "Model with interactive terms and designs", there are more than 2% improvement in "Goodness of fit".

We use the average of "Age" and "Age 2" estimated values to plot a figure to show the implicit prices of apartment at different age, ceteris paribus. We compare the results from this specification form with the results from the Basic Model 1.

(Figure 2 about here)

In the model with "Interactive terms" using restricted sample, apartments depreciate over time, since the implicit value of "Age" decreases at a increasing rate. On the other hand, apartments can appreciate over time according to the result from Basic model 1.

Furthermore, we also use the average of "Floor" and "Floor 2" estimated values to simulate the implicit prices of apartment at different floor. Both curves are concave; however, their maximum values are different and appear at different floor. In the model with "Interactive terms" using restricted sample, the maximum value is 0.1156, which appears at 26^{th} floor's dwelling. Whereas, in Basic model 1, the maximum value is 0.099 which appears at 22^{nd} floor's dwelling and it will become negative value while the apartment is located on or above 44^{th} floor.

(Figure 3 about here)

Chapter Seven

Limitations and Future direction

Actually, different clubhouses provide different amenities and facilities to residents. Some clubhouses may have a swimming pool but may not have tennis courts; however, some clubhouses may have both.[38] Our results can show that residents always value "Clubhouse" positively but we don't know their preference toward different kinds of amenities. In the future, researchers can collect the data about the facilities of various clubhouses and analyze the implicit prices of different facilities.

According to our findings, the apartment with "Deck" or "Roof" can always be sold at a premium, ceteris paribus. However, we don't think it is a good idea to use dummy variable "Deck" and "Roof" to indicate whether the apartment has such feature or not, as the actual size of such feature should never be standardized; therefore, the usefulness of the results should be questioned. We are convinced that the results would be more meaningful if we can have the size of "Deck" and size of "Roof". Thus, we can know the additional one square feet increase in gross-size or net-size of "Deck" or "Roof" will contribute how much to the transaction price of the dwelling.

[38] Recently, developers improve the quality of their clubhouses which provide more facilities and services to residents. For example, the clubhouse of Caribbean Coast, in Tung Chung, has a large in-door swimming pool, tennis courts, library, restaurants, etc.

Nevertheless, we understand that it must be a difficult task to obtain this piece of information, as researchers need to collect the more professional floor plan from developers or architecture firms and then to measure the size by hands.

All of our sampling housing estates belong to the categories of starter home and home for middle class, therefore, our results can, to a large extent, represent the preference of those classes' residents, and however, we don't think it is appropriate to apply our findings on luxurious apartments. As we believe that high-income class should taste the same attribute different from middle class and low-income class. For example, according to the findings from the Model with "Interactive terms and design" using restricted sample, more than 55% estimated coefficients of "Balcony" are negatively significant at 5% level, and if the apartment with "Balcony" will lead to 2.22% drop in transaction value on average, other housing attributes being the same.

We can conclude that this class of residents values this housing feature negatively, but we can not say all residents value it negatively. It is possible that "Balcony" coefficients are positively significant while using the same specification form to analyze luxurious housing market. Therefore, there is a need to design the most suitable and feasible specification before doing a housing research project. For instance, rich people may rely on public

transport system less than low and medium-income class people do, therefore, to analyze the implicit prices of luxurious apartment's attributes, researchers should consider those factors like "Car-park per house".

Chapter Eight

Concluding Remarks

Other things being equal, does the interior design of a housing unit matter? The answer seems to be positive. This paper takes a preliminary step to provide scientific evidence for this conjecture. To do this, we have chosen a collection of most frequently traded estates in the Hong Kong residential property market. Since there are all apartment buildings, there will be many identically designed units in different floors and with different views. At the same time, there are units differentiated by design and views on the same floor. In addition, racial discrimination problem virtually does not exist in Hong Kong. All public facilities including schools, police, etc., are funded by the Hong Kong government, and district governments within Hong Kong virtually do not exist and hence local public finance will not be a concern.[39] All these features of the market create a very desirable environment to investigate the value of interior design.

[39] Among others, see Hanushek and Yilmaz (2007a, b) for a discussion on how the local public finance issue can significantly impact the housing price.

We find that some of the "design variables" are statistically significant. Moreover, the "design variables" also interact with other variables, such as the "net ratio", "distance from CBD", "estate scale", etc. in a statistically significant manner. Thus, it seems natural to further investigate how real estate developers make their decisions on the interior design given the location of the land is determined. These questions will be pursued in the future research. Since interior design of a housing unit is important that potential buyers can value differently to various design features, this paper can reveal the buyers' preference toward interior layout and we find that individual homebuyers are willing to pay a premium for certain interior layout features but not for others, therefore, property developers and architectural firms can produce more attractive housing units and then the living standard of residents can be improved.

Appendix One

Tables

Table 1 Estates included in the sample

	Number of Units	Number of Buildings	Number of floors
Hong Kong Island			
Chi Fu Fa Yuen	4326	27	27
City Garden	2393	14	28
Heng Fu Chuen	6311	48	18-22
Kornhill	6615	32	19-31
Lei King Wan	2295	17	17-19
Nan Fung Sun Chuen	2826	12	28-32
Pokfulan Garden	1120	6	28
South Horizons	9232	34	40-42
Tai Koo Shing	12690	61	28
Total	47808	251	
Kowloon			
Amoy Garden	4896	19	26-36
Laguna City	8071	38	25-28
Mei Foo Sun Chuen	13063	99	20
Sceneway Garden	4112	17	28-34
Tak Bo Graden	1888	8	33-40
Telford Garden	4065	21	10-26
Whampoa Garden	10287	88	15
Whampoa Estate	2820	25	15
Total	49202	315	
the New Territories			
Allway Garden	3418	16	33-36
Belvedere Garden	6016	19	35-45
City One Shatin	10642	52	27-33
Fanling Centre	2200	11	20-25
Kingswood Villas	15836	58	27-38
Luk Yueng Sun Chuen	3624	16	30
Miami Beach Towers	1272	6	37
Riviera Garden	5636	20	30-40
Tai Hing Garden	3740	15	34
Tai Po Center	4080	18	33
Tsuen King Garden	2968	12	32-34
Tsuen Wan Center	4454	19	28-36
Tuen Mun Town Center	2258	8	30-32
Sun Tuen Mun Centre	3520	10	44
Uptown Plaza	1240	6	29
Serenity Park	2450	15	23
Total	73354	301	

Table 2 Description of Research Variables

Variable	Description	Expected sign
Dependent Variable		
ln Price	Log selling price of a housing unit (in HK$million)	
Independent Variables		
Structural Attributes		
Age	Age of the housing unit (in years)	-
Age2	Square of age	+
Floor	Floor level of the housing unit	+
Floor2	Square of floor level	-
Gross size	Total gross area of the flat (sq-footage)	+
Gross size 2	Square of gross size	-
Net ratio	The ratio of net size to gross size.	+
Clubhouse	If clubhouse is available within the estate, this dummy is 1, otherwise=0.	+
Lucky Number	If the floor level is 8,18,28, 38 or 48, LuckyNumber=1, otherwise=0.	+
Estate scale	The total number of apartments in this housing estate	+
Neighborhood Attributes		
MTR 500	If MTR is available within 0-500 metres, MTR500=1, otherwise=0.	+
KCR 500	If KCR is available within 0-500 metres, KCR500=1, otherwise=0.	+
Open Space 500	If distance from open space within 0-500 metres, this dummy=1, otherwise=0.	+
Water 500	If distance from waters within 0-500 metres, this dummy=1, otherwise=0.	+
Locational Attributes		
Distance from CBD	Distance to the Central Business District	-
Distance from CBD 2	Square of distance to the Central Business District	+
Hong Kong Island	If the housing unit is located on Hong Kong Island, this dummy=1, otherwise=0.	+
Kowloon	If the housing unit is located on Kowloon peninsula, this dummy=1, otherwisw=0.	+
Floor Layout Attributes		
Foyer	Presence of foyer=1, otherwise=0.	-
Corridor	Presence of coridor=1, otherwise=0.	-
Balcony	Presence of balcony=1, otherwise=0.	-/+
No. of bedrooms	Total number of bedrooms of the apartment	-
No. of toilet	Total number of toilets of the apartment	-
Kitchen accessible to living room	If kitchen is accessible to living room, the dummy=1, otherwise=0.	-/+
Kitchen adjacent to bedrooms	If kitchen is adjacant to bedroom, the dummy=1, otherwise=0.	-
Toilet adjacent to bedrooms	If toilet is adjacant to bedroom, this dummy=1,otherwise=0.	-/+
Diamond	Presence of diamond-shape living room=1, otherwise=0.	-/+
L-shape	Presence of L shape living room=1, otherwise=0.	-/+
Rectangular	Presence of rectangular living room=1, otherwise=0.	-/+
Store room	Presence of store room=1, otherwise=0.	+
Roof	Presence of roof =1, otherwise=0.	+
Deck	Presence of deck=1, otherwise=0.	
Views Attributes		
Sea-view	Sea view=1, otherwise=0.	+
Interactive terms		
Age & Diamond	Variable "Age" times variable "Diamond"	-/+
Gross Size & Diamond	Variable "Gross size" times variable "Diamond"	-/+
Net Ratio & Diamond	Variable "Net Ratio" times variable "Diamond"	-/+
Distance from CBD & Diamond	Variable "Distance from CBD" times variable "Diamond"	-/+
Estate Scale & Diamond	Variable "Estate Scale" times variable "Diamond"	-/+
Age & L-shape	Variable "Age" times variable "L-shape"	-/+
Gross Size & L-shape	Variable "Gross size" times variable "L-shape"	-/+
Net Ratio & L-shape	Variable "Net Ratio" times variable "L-shape"	-/+
Distance from CBD & L-shape	Variable "Distance from CBD" times variable "L-shape"	-/+
Estate Scale & L-shape	Variable "Estate Scale" times variable "L-shape"	-/+
Age & Rectangular-shape	Variable "Age" times variable "Rectangular"	-/+
Gross Size & Rectangular-shape	Variable "Gross size" times variable "Rectangular"	-/+
Net Ratio & Rectangular-shape	Variable "Net Ratio" times variable "Rectangular"	-/+
Distance from CBD & Rectangular-shape	Variable "Distance from CBD" times variable "Rectangular"	-/+
Estate Scale & Rectangular-shape	Variable "Estate Scale" times variable "Rectangular"	-/+

Table 3a Descriptive Statistics

	Mean	Standard Deviation	Min	Max	Median
Dependent Variables					
ln_price	0.7985	0.5258	-5.298317	3.367296	0.7839016
Independent Variables					
Structural Attributes					
Age	10.3581	7.5638	0	37	9
Age2	164.5004	210.6440	0	1369	81
Floor	15.6399	9.4016	0	45	15
Floor2	332.9954	345.2236	0	2025	225
Gross size	676.8731	178.8206	273	2166	666
Gross size 2	490133.8000	276226.8000	74529	4691556	443556
Net ratio	0.8170	0.0456	0.42	0.99	0.81
Clubhouse	0.7766	0.4165	0	1	1
Lucky Number	0.0941	0.2920	0	1	0
Estate scale	8087.5670	4530.6620	1120	15836	8071
Neighborhood Attributes					
MTR 500	0.3653	0.4815	0	1	0
KCR 500	0.0631	0.2432	0	1	0
Open Space 500	0.7060	0.4556	0	1	0
Water 500	0.4034	0.4906	0	1	0
Locational Attributes					
Distance from CBD	14.4215	10.8346	1.8	36.6	11
Distance from CBD 2	325.3690	452.4455	3.24	1339.56	121
Hong Kong Island	0.2680	0.4429	0	1	0
Kowloon	0.2936	0.4554	0	1	0
Floor Layout Attributes					
Foyer	0.2052	0.4038	0	1	0
Corridor	0.8228	0.3818	0	1	1
Balcony	0.0829	0.2758	0	1	0
No. of bedrooms	2.4719	0.5521	1	5	2
No. of toilet	1.2996	0.4707	1	3	1
Kitchen accessible to living room	0.7683	0.4219	0	1	1
Kitchen adjacent to bedrooms	0.0939	0.2916	0	1	0
Toilet adjacent to bedrooms	0.9846	0.1233	0	1	1
Diamond	0.4062	0.4911	0	1	0
L-shape	0.1950	0.3962	0	1	0
Rectangular	0.2948	0.4559	0	1	0
Store room	0.0978	0.2971	0	1	0
Roof	0.0444	0.2059	0	1	0
Deck	0.0020	0.0446	0	1	0
Views Attributes					
Sea-view	0.0741	0.2620	0	1	0
Interactive terms					
Age & Diamond	2.3363	4.2417	0	25	0
Gross Size & Diamond	307.8255	384.2294	0	2166	0
Net Ratio & Diamond	0.3301	0.3997	0	0.97	0
Distance from CBD & Diamond	6.9300	12.1950	0	36.6	0
Estate Scale & Diamond	4393.8660	5854.5870	0	15836	0
Age & L-shape	2.6008	6.3973	0	37	0
Gross Size & L-shape	134.2034	284.0552	0	1688	0
Net Ratio & L-shape	0.1626	0.3309	0	0.99	0
Distance from CBD & L-shape	2.6498	6.5456	0	31	0
Estate Scale & L-shape	1289.6370	3197.4830	0	13063	0
Age & Rectangular-shape	3.8435	7.1649	0	37	0
Gross Size & Rectangular-shape	168.5468	274.4680	0	1494	0
Net Ratio & Rectangular-shape	0.2378	0.3690	0	0.98	0
Distance from CBD & Rectangular-shape	3.8612	7.2167	0	31	0
Estate Scale & Rectangular-shape	1700.4730	3356.6140	0	13063	0
No. of observations	222562				

Table 3b Correlation coefficients of structural and neighbourhood attributes

	Age	Age2	Floor	Floor2	Gross size	Gross size2	Net ratio	Clubhouse	Lucky Number	MTR500	KCR500	Open Space 500	Water 500	Distance from CBD	Distance from CBD2	Hong Kong Island	Kowloon	Estate Scale
Age	1																	
Age2	0.9382	1																
Floor	-0.1248	-0.1196	1															
Floor2	-0.1395	-0.1326	0.9603	1														
Gross size	-0.0975	-0.0231	-0.0449	-0.034	1													
Gross size2	-0.0521	0.0111	-0.0393	-0.0294	0.9791	1												
Net ratio	0.3007	0.2655	-0.1337	-0.125	0.3983	0.3616	1											
Clubhouse	-0.4474	-0.4723	0.069	0.0728	0.1607	0.1294	-0.124	1										
Lucky Number	0.0077	0.0067	0.0383	0.0204	0.0008	0.0012	0.0041	-0.0006	1									
MTR500	0.4753	0.4206	-0.1276	-0.1485	0.0656	0.0812	0.3322	-0.2998	0.0195	1								
KCR500	0.1036	0.1922	-0.0663	-0.0785	-0.0673	-0.0612	-0.1288	-0.0838	0.0016	-0.0655	1							
Open Space 500	-0.1822	-0.1023	-0.0427	-0.0532	0.1967	0.1737	-0.0552	0.351	-0.0032	-0.2892	0.167	1						
Water 500	-0.1884	-0.2183	-0.0205	-0.0009	0.3802	0.3369	0.4082	0.3819	-0.0024	-0.0952	-0.2128	0.3401	1					
Distance from CBD	-0.4687	-0.3694	0.1677	0.1743	-0.0803	-0.1105	-0.4385	0.1647	0.0011	-0.4103	0.0326	0.2468	-0.3485	1				
Distance from CBD2	-0.4538	-0.3478	0.1357	0.1438	-0.0469	-0.0814	-0.3928	0.1676	-0.0025	-0.3978	-0.0202	0.2467	-0.3422	0.9811	1			
Hong Kong Island	0.0421	0.0108	-0.0271	-0.0341	0.3243	0.3014	0.3629	0.2592	0.0185	0.3517	-0.1566	0.0113	0.4371	-0.315	-0.3275	1		
Kowloon	0.2627	0.2755	-0.178	-0.1818	0.0024	0.0207	-0.0008	-0.2794	-0.017	0.3055	-0.0285	-0.066	-0.027	-0.4419	-0.3585	-0.3896	1	
Estate Scale	-0.0884	0.028	-0.0199	-0.0224	0.289	0.258	0.0508	0.2246	-0.006	-0.1316	-0.1486	0.5409	0.0159	0.3307	0.4238	-0.0034	-0.0483	1

Table 3c Correlation Coefficients (Living room shapes and other explanatory variables)

	Diamond	L-shape	Rectangular	Two-rectangle
Age	-0.5039	0.1934	0.23	0.2164
Age2	-0.4194	0.1863	0.1844	0.1577
Floor	-0.0149	-0.0025	0.0303	-0.0181
Floor2	-0.0049	-0.003	0.0246	-0.025
Gross size	0.3749	0.0315	-0.3806	-0.0757
Gross size2	0.3196	0.0286	-0.324	-0.0675
Net ratio	-0.0773	0.1817	-0.1487	0.1108
Clubhouse	0.4286	-0.2325	-0.1293	-0.1951
Lucky Number	-0.015	0.0033	0.0099	0.0052
MTR500	-0.2816	0.1143	0.0069	0.2946
KCR500	-0.2142	0.1056	0.1881	-0.0733
Open Space 500	0.2542	-0.0375	-0.1177	-0.1847
Water 500	0.1998	0.002	-0.2073	-0.0144
Distance from CBD	0.2017	-0.0377	-0.0794	-0.1572
Distance from CBD2	0.2909	-0.0757	-0.1407	-0.1598
Hong Kong Island	0.1295	-0.0466	-0.1495	0.0754
Kowloon	0.0703	-0.0291	-0.0944	0.0657
Estate Scale	0.4988	-0.1605	-0.3312	-0.0997
Foyer	-0.4191	0.0852	0.3023	0.1124
Corridor	0.384	0.0171	-0.3626	-0.0985
Balcony	-0.0765	0.1259	0.0112	-0.0571
No. of bedrooms	0.3008	-0.0429	-0.2221	-0.0966
No. of toilet	0.3029	-0.0176	-0.2272	-0.1254
Kitchen accessible to living room	0.3746	-0.065	-0.2461	-0.151
Kitchen adjacent to bedrooms	-0.1498	0.0658	0.0478	0.0845
Toilet adjacent to bedrooms	0.1037	-0.1254	-0.0268	0.036
Store room	0.1197	0.0205	-0.1761	0.0438
Roof	-0.1316	-0.0414	0.2072	-0.044
Deck	-0.0348	-0.0029	0.0491	-0.0136
Sea-view	0.1236	0.0093	-0.0819	-0.0886

Table 3d No. of transaction in each sampling period (Quarterly)

Quarter	No. of transaction	Quarter	No. of transaction	Quarter	No. of transaction	Quarter	No. of transaction
Q1-1992	7269	Q3-1995	4364	Q1-1999	2620	Q3-2002	1640
Q2-1992	4869	Q4-1995	5666	Q2-1999	2901	Q4-2002	1737
Q3-1992	5165	Q1-1996	7261	Q3-1999	2246	Q1-2003	1399
Q4-1992	3379	Q2-1996	7086	Q4-1999	1783	Q2-2003	1721
Q1-1993	5474	Q3-1996	5388	Q1-2000	2229	Q3-2003	2247
Q2-1993	8877	Q4-1996	9458	Q2-2000	1902	Q4-2003	2111
Q3-1993	4386	Q1-1997	9423	Q3-2000	2668	Q1-2004	3436
Q4-1993	3732	Q2-1997	10049	Q4-2000	1903	Q2-2004	2000
Q1-1994	6832	Q3-1997	4192	Q1-2001	2171	Q3-2004	2622
Q2-1994	3948	Q4-1997	3573	Q2-2001	2428	Q4-2004	3288
Q3-1994	3433	Q1-1998	3360	Q3-2001	2234	Q1-2005	4987
Q4-1994	3569	Q2-1998	2674	Q4-2001	2461	Q2-2005	5420
Q1-1995	5346	Q3-1998	2750	Q1-2002	2314	Q3-2005	3208
Q2-1995	5533	Q4-1998	4909	Q2-2002	2146	Q4-2005	2775

No. of observation = 222562

Table 4a Estimated results from several models (Positively significant)

No. of period = 56	Positive Significant at 0.05 Level					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Age	***96.43%***	3.57%	7.14%	12.50%	3.57%	3.57%
Age2	0.00%	7.14%	5.36%	5.36%	0.00%	0.00%
Floor	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Floor2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross size	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Gross size2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Net ratio	-	***100.00%***	***98.21%***	***100.00%***	***100.00%***	***100.00%***
Clubhouse	***73.21%***	***85.71%***	***82.14%***	***85.71%***	***75.00%***	***75.00%***
Lucky Number	8.93%	12.50%	21.43%	21.43%	21.43%	21.43%
MTR500	***46.43%***	***100.00%***	***100.00%***	***100.00%***	***98.21%***	***98.21%***
KCR500	***100.00%***	***91.07%***	***96.43%***	***96.43%***	***92.86%***	***92.86%***
Open Space 500	12.50%	***94.64%***	***92.86%***	***91.07%***	***83.93%***	***85.71%***
Water 500	***100.00%***	0.00%	1.79%	0.00%	0.00%	0.00%
Distance from CBD	-	0.00%	0.00%	0.00%	0.00%	0.00%
Distance from CBD2	-	35.71%	32.14%	30.36%	***64.29%***	***64.29%***
Hong Kong Island	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Kowloon	***100.00%***	***80.36%***	***57.14%***	***66.07%***	16.07%	17.86%
Estate Scale	-	***82.14%***	***67.86%***	***73.21%***	32.14%	37.50%
Foyer	-	-	1.79%	1.79%	0.00%	0.00%
Corridor	-	-	28.57%	28.57%	3.57%	1.79%
Balcony	-	-	7.14%	7.14%	21.43%	21.43%
No. of bedrooms	-	-	1.79%	1.79%	0.00%	0.00%
No. of toilet	-	-	0.00%	0.00%	0.00%	0.00%
Kitchen accessible to living room	-	-	12.50%	12.50%	25.00%	23.21%
Kitchen adjacent to bedrooms	-	-	0.00%	0.00%	0.00%	0.00%
Toilet adjacent to bedrooms	-	-	41.07%	41.07%	23.21%	23.21%
Diamond*	-	-	32.14%	35.71%	***91.07%***	***92.86%***
L-shape*	-	-	39.29%	41.07%	***85.71%***	***89.29%***
Rectangular*	-	-	7.14%	10.71%	***69.64%***	***71.43%***
Store room	-	-	5.36%	8.93%	5.36%	5.36%
Roof	-	-	***67.86%***	***73.21%***	***66.07%***	***66.07%***
Deck	-	-	***60.71%***	***62.50%***	***62.50%***	***69.64%***
Sea-view	-	***92.86%***	***94.64%***	***96.43%***	***96.43%***	***98.21%***
Age & Diamond	-	-	-	-	17.86%	16.07%
Gross Size & Diamond	-	-	-	-	0.00%	0.00%
Net Ratio & Diamond	-	-	-	-	0.00%	0.00%
Distance from CBD & Diamond	-	-	-	-	0.00%	0.00%
Estate Scale & Diamond	-	-	-	-	***64.29%***	***64.29%***
Age & L-shape	-	-	-	-	1.79%	1.79%
Gross Size & L-shape	-	-	-	-	1.79%	3.57%
Net Ratio & L-shape	-	-	-	-	0.00%	0.00%
Distance from CBD & L-shape	-	-	-	-	0.00%	0.00%
Estate Scale & L-shape	-	-	-	-	***53.57%***	***58.93%***
Age & Rectangular-shape	-	-	-	-	35.71%	35.71%
Gross Size & Rectangular-shape	-	-	-	-	19.64%	19.64%
Net Ratio & Rectangular-shape	-	-	-	-	0.00%	0.00%
Distance from CBD & Rectangular-shape	-	-	-	-	14.29%	14.29%
Estate Scale & Rectangular-shape	-	-	-	-	42.86%	46.43%
Mean R-square	0.8170	0.8676	0.8711	0.8941	0.8764	0.8993
Mean Adj. R-square	0.8160	0.8663	0.8694	0.8927	0.8740	0.8974

*"Two-rectangle" is controlled

Table 4b Estimated results from several models (Negatively significant)

No. of period = 56	Negative Significant at 0.05 Level					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Age	0.00%	***66.07%***	***57.14%***	***58.93%***	44.64%	***50.00%***
Age2	***100.00%***	***62.50%***	***69.64%***	***69.64%***	***71.43%***	***73.21%***
Floor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Floor2	***96.43%***	***96.43%***	***98.21%***	***96.43%***	***94.64%***	***98.21%***
Gross size	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross size2	***100.00%***	***98.21%***	***98.21%***	***100.00%***	***92.86%***	***98.21%***
Net ratio	-	0.00%	0.00%	0.00%	0.00%	0.00%
Clubhouse	3.57%	0.00%	0.00%	0.00%	0.00%	0.00%
Lucky Number	0.00%	0.00%	0.00%	0.00%	0.00%	1.79%
MTR500	16.07%	0.00%	0.00%	0.00%	0.00%	0.00%
KCR500	0.00%	0.00%	0.00%	0.00%	1.79%	1.79%
Open Space 500	***73.21%***	0.00%	0.00%	0.00%	0.00%	0.00%
Water 500	0.00%	***80.36%***	***71.43%***	***71.43%***	***76.79%***	***82.14%***
Distance from CBD	-	***100.00%***	***100.00%***	***100.00%***	***96.43%***	***89.29%***
Distance from CBD2	-	19.64%	17.86%	17.86%	7.14%	7.14%
Hong Kong Island	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kowloon	0.00%	3.57%	0.00%	0.00%	26.79%	26.79%
Estate Scale	-	0.00%	0.00%	0.00%	0.00%	0.00%
Foyer	-	-	44.64%	48.21%	12.50%	12.50%
Corridor	-	-	3.57%	5.36%	30.36%	35.71%
Balcony	-	-	44.64%	***48.21%***	***50.00%***	***55.36%***
No. of bedrooms	-	-	35.71%	35.71%	46.43%	44.64%
No. of toilet	-	-	***87.50%***	***87.50%***	***75.00%***	***80.36%***
Kitchen accessible to living room	-	-	7.14%	10.71%	3.57%	3.57%
Kitchen adjacent to bedrooms	-	-	39.29%	42.86%	***64.29%***	***69.64%***
Toilet adjacent to bedrooms	-	-	1.79%	3.57%	7.14%	8.93%
Diamond*	-	-	7.14%	8.93%	0.00%	0.00%
L-shape*	-	-	7.14%	8.93%	0.00%	0.00%
Rectangular*	-	-	10.71%	14.29%	0.00%	0.00%
Store room	-	-	35.71%	35.71%	33.93%	33.93%
Roof	-	-	0.00%	0.00%	0.00%	0.00%
Deck	-	-	0.00%	0.00%	0.00%	0.00%
Sea-view	-	0.00%	0.00%	0.00%	0.00%	0.00%
Age & Diamond	-	-	-	-	23.21%	23.21%
Gross Size & Diamond	-	-	-	-	50.00%	48.21%
Net Ratio & Diamond	-	-	-	-	***85.71%***	***87.50%***
Distance from CBD & Diamond	-	-	-	-	***94.64%***	***94.64%***
Estate Scale & Diamond	-	-	-	-	3.57%	3.57%
Age & L-shape	-	-	-	-	25.00%	32.14%
Gross Size & L-shape	-	-	-	-	19.64%	19.64%
Net Ratio & L-shape	-	-	-	-	***83.93%***	***83.93%***
Distance from CBD & L-shape	-	-	-	-	***73.21%***	***75.00%***
Estate Scale & L-shape	-	-	-	-	0.00%	0.00%
Age & Rectangular-shape	-	-	-	-	0.00%	0.00%
Gross Size & Rectangular-shape	-	-	-	-	3.57%	3.57%
Net Ratio & Rectangular-shape	-	-	-	-	***76.79%***	***78.57%***
Distance from CBD & Rectangular-shape	-	-	-	-	25.00%	28.57%
Estate Scale & Rectangular-shape	-	-	-	-	0.00%	0.00%

*"Two-rectangle" is controlled

Table 4c Estimated results from several models (Insignificant)

No. of period = 56	Insignifcant					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Age	3.57%	30.36%	35.71%	28.57%	***51.79%***	46.43%
Age2	0.00%	30.36%	25.00%	25.00%	28.57%	26.79%
Floor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Floor2	3.57%	3.57%	1.79%	3.57%	5.36%	1.79%
Gross size	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross size2	0.00%	1.79%	1.79%	0.00%	7.14%	1.79%
Net ratio	-	0.00%	1.79%	0.00%	0.00%	0.00%
Clubhouse	23.21%	14.29%	17.86%	14.29%	25.00%	25.00%
Lucky Number	***91.07%***	***87.50%***	***78.57%***	***78.57%***	***78.57%***	***76.79%***
MTR500	37.50%	0.00%	0.00%	0.00%	1.79%	1.79%
KCR500	0.00%	8.93%	3.57%	3.57%	5.36%	5.36%
Open Space 500	14.29%	5.36%	7.14%	8.93%	16.07%	14.29%
Water 500	0.00%	19.64%	26.79%	28.57%	23.21%	17.86%
Distance from CBD	-	0.00%	0.00%	0.00%	3.57%	10.71%
Distance from CBD2	-	***44.64%***	***50.00%***	***51.79%***	28.57%	28.57%
Hong Kong Island	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kowloon	0.00%	16.07%	42.86%	33.93%	***57.14%***	***55.36%***
Estate Scale	-	17.86%	32.14%	26.79%	***67.86%***	***62.50%***
Foyer	-	-	***53.57%***	***50.00%***	***87.50%***	***87.50%***
Corridor	-	-	***67.86%***	***66.07%***	***66.07%***	***62.50%***
Balcony	-	-	48.21%	44.64%	28.57%	23.21%
No. of bedrooms	-	-	***62.50%***	***62.50%***	***53.57%***	***55.36%***
No. of toilet	-	-	12.50%	12.50%	25.00%	19.64%
Kitchen accessible to living room	-	-	***80.36%***	***76.79%***	***71.43%***	***73.21%***
Kitchen adjacent to bedrooms	-	-	***60.71%***	***57.14%***	35.71%	30.36%
Toilet adjacent to bedrooms	-	-	***57.14%***	***55.36%***	***69.64%***	***67.86%***
Diamond*	-	-	***60.71%***	***55.36%***	8.93%	7.14%
L-shape*	-	-	***53.57%***	***50.00%***	14.29%	10.71%
Rectangular*	-	-	***82.14%***	***75.00%***	30.36%	28.57%
Store room	-	-	***58.93%***	***55.36%***	***60.71%***	***60.71%***
Roof	-	-	32.14%	26.79%	33.93%	33.93%
Deck	-	-	39.29%	37.50%	37.50%	30.36%
Sea-view	-	7.14%	5.36%	3.57%	3.57%	1.79%
Age & Diamond	-	-	-	-	***58.93%***	***60.71%***
Gross Size & Diamond	-	-	-	-	***50.00%***	***51.79%***
Net Ratio & Diamond	-	-	-	-	14.29%	12.50%
Distance from CBD & Diamond	-	-	-	-	5.36%	5.36%
Estate Scale & Diamond	-	-	-	-	32.14%	32.14%
Age & L-shape	-	-	-	-	***73.21%***	***66.07%***
Gross Size & L-shape	-	-	-	-	***78.57%***	***76.79%***
Net Ratio & L-shape	-	-	-	-	16.07%	16.07%
Distance from CBD & L-shape	-	-	-	-	26.79%	25.00%
Estate Scale & L-shape	-	-	-	-	46.43%	41.07%
Age & Rectangular-shape	-	-	-	-	***64.29%***	***64.29%***
Gross Size & Rectangular-shape	-	-	-	-	***76.79%***	***76.79%***
Net Ratio & Rectangular-shape	-	-	-	-	23.21%	21.43%
Distance from CBD & Rectangular-shape	-	-	-	-	***60.71%***	***57.14%***
Estate Scale & Rectangular-shape	-	-	-	-	***57.14%***	***53.57%***

*"Two-rectangle" is controlled

Table 4d Estimated results from several models (Average value of estimated coefficients)

No. of period = 56	Average value of estimated coefficients					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	-1.344862	-1.461523	-1.477887	-1.480143	-2.168005	-2.165886
Age	0.036202	-0.010042	-0.007169	-0.007152	-0.007194	-0.006774
Age2	-0.001332	-0.000334	-0.000394	-0.000390	-0.000452	-0.000453
Floor	0.008978	0.008770	0.009170	0.009202	0.008979	0.009016
Floor2	-0.000203	-0.000175	-0.000187	-0.000189	-0.000174	-0.000176
Gross size	0.002715	0.002352	0.002464	0.002467	0.002428	0.002446
Gross size2	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001
Net ratio	-	1.184439	1.147821	1.146622	2.052476	2.027167
Clubhouse	0.055201	0.074589	0.068427	0.068666	0.056888	0.057355
Lucky Number	0.006658	0.007673	0.008561	0.008370	0.008585	0.008413
MTR500	0.018508	0.108097	0.114956	0.114105	0.139999	0.139891
KCR500	0.270695	0.142853	0.159359	0.158565	0.166253	0.165364
Open Space 500	-0.036402	0.076364	0.072193	0.071097	0.066498	0.064889
Water 500	0.129891	-0.063255	-0.049679	-0.048278	-0.069590	-0.068178
Distance from CBD	-	-0.020363	-0.020320	-0.019790	-0.019918	-0.019054
Distance from CBD2	-	0.000031	0.000038	0.000027	0.000215	0.000193
Hong Kong Island	0.401625	0.209835	0.197456	0.196613	0.180695	0.179154
Kowloon	0.279155	0.055402	0.048723	0.050090	-0.001049	0.000577
Estate Scale	-	0.000006	0.000005	0.000005	0.000002	0.000003
Foyer	-	-	-0.019538	-0.020605	-0.006578	-0.007551
Corridor	-	-	0.002821	0.002598	-0.012656	-0.013180
Balcony	-	-	-0.024076	-0.024431	-0.022426	-0.022194
No. of bedrooms	-	-	-0.012874	-0.011800	-0.015858	-0.015288
No. of toilet	-	-	-0.040283	-0.042761	-0.031336	-0.034210
Kitchen accessible to living room	-	-	-0.000016	-0.001386	0.006072	0.004571
Kitchen adjacent to bedrooms	-	-	-0.022482	-0.025059	-0.039054	-0.041373
Toilet adjacent to bedrooms	-	-	0.028999	0.029901	0.004568	0.006642
Diamond*	-	-	0.016537	0.016830	1.614555	1.602506
L-shape*	-	-	0.010892	0.009558	1.139441	1.120379
Rectangular*	-	-	-0.001250	-0.001586	0.644822	0.629526
Store room	-	-	-0.007443	-0.007695	-0.011765	-0.011941
Roof	-	-	0.053125	0.052621	0.044689	0.044827
Deck	-	-	0.135103	0.133553	0.141639	0.140482
Sea-view	-	0.081907	0.080944	0.081503	0.091163	0.091848
Age & Diamond	-	-	-	-	-0.001225	-0.001611
Gross Size & Diamond	-	-	-	-	-0.000117	-0.000118
Net Ratio & Diamond	-	-	-	-	-1.735566	-1.715208
Distance from CBD & Diamond	-	-	-	-	-0.013629	-0.013660
Estate Scale & Diamond	-	-	-	-	0.000011	0.000011
Age & L-shape	-	-	-	-	-0.003638	-0.003697
Gross Size & L-shape	-	-	-	-	-0.000044	-0.000040
Net Ratio & L-shape	-	-	-	-	-1.227010	-1.201316
Distance from CBD & L-shape	-	-	-	-	-0.007768	-0.007760
Estate Scale & L-shape	-	-	-	-	0.000008	0.000007
Age & Rectangular-shape	-	-	-	-	0.004351	0.004282
Gross Size & Rectangular-shape	-	-	-	-	0.000023	0.000024
Net Ratio & Rectangular-shape	-	-	-	-	-0.892649	-0.867490
Distance from CBD & Rectangular-shape	-	-	-	-	-0.003249	-0.003227
Estate Scale & Rectangular-shape	-	-	-	-	0.000006	0.000005

*"Two-rectangle" is controlled

Table 4e Estimated results from several models (Standard derivation of estimated coefficients)

No. of period = 56	Standard deviation of estimated coefficients					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "Interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	0.431947	0.311615	0.350746	0.343979	0.555986	0.544567
Age	0.019626	0.011690	0.012651	0.012562	0.012480	0.011698
Age2	0.000553	0.000306	0.000323	0.000326	0.000307	0.000302
Floor	0.001858	0.001444	0.001502	0.001365	0.001493	0.001365
Floor2	0.000056	0.000044	0.000047	0.000038	0.000045	0.000037
Gross size	0.000270	0.000304	0.000311	0.000306	0.000346	0.000323
Gross size2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Net ratio	-	0.218076	0.216070	0.193401	0.535461	0.479037
Clubhouse	0.043579	0.033633	0.033268	0.032945	0.034271	0.033641
Lucky Number	0.015670	0.013765	0.013685	0.012996	0.014186	0.013652
MTR500	0.038337	0.027287	0.032267	0.031866	0.035798	0.035621
KCR500	0.088040	0.072454	0.072111	0.071267	0.078135	0.078896
Open Space 500	0.043657	0.039082	0.037345	0.037458	0.038566	0.039897
Water 500	0.043115	0.032400	0.034182	0.034889	0.036691	0.038824
Distance from CBD	-	0.006572	0.006014	0.005474	0.006575	0.006393
Distance from CBD2	-	0.000184	0.000183	0.000169	0.000221	0.000195
Hong Kong Island	0.080788	0.082348	0.081652	0.080055	0.079325	0.076694
Kowloon	0.059585	0.047327	0.042660	0.040601	0.043426	0.042000
Estate Scale	-	0.000004	0.000004	0.000003	0.000005	0.000005
Foyer	-	-	0.018548	0.018718	0.018208	0.019079
Corridor	-	-	0.019728	0.018739	0.016983	0.015491
Balcony	-	-	0.039003	0.039295	0.051526	0.051123
No. of bedrooms	-	-	0.021959	0.019885	0.021254	0.018253
No. of toilet	-	-	0.017984	0.013765	0.020986	0.016381
Kitchen accessible to living room	-	-	0.018844	0.018985	0.020345	0.020931
Kitchen adjacent to bedrooms	-	-	0.024833	0.023316	0.025791	0.024081
Toilet adjacent to bedrooms	-	-	0.047166	0.045430	0.043470	0.040818
Diamond*	-	-	0.030230	0.031244	0.579035	0.552793
L-shape*	-	-	0.025619	0.025854	0.512283	0.466316
Rectangular*	-	-	0.020333	0.020268	0.563326	0.537321
Store room	-	-	0.022597	0.020211	0.022668	0.020376
Roof	-	-	0.023908	0.022086	0.024695	0.023154
Deck	-	-	0.069178	0.068530	0.067518	0.068057
Sea-view	-	0.031398	0.029992	0.029035	0.030983	0.029613
Age & Diamond	-	-	-	-	0.009689	0.008997
Gross Size & Diamond	-	-	-	-	0.000138	0.000133
Net Ratio & Diamond	-	-	-	-	0.697721	0.655515
Distance from CBD & Diamond	-	-	-	-	0.007738	0.007484
Estate Scale & Diamond	-	-	-	-	0.000010	0.000009
Age & L-shape	-	-	-	-	0.003639	0.003914
Gross Size & L-shape	-	-	-	-	0.000143	0.000139
Net Ratio & L-shape	-	-	-	-	0.611706	0.545529
Distance from CBD & L-shape	-	-	-	-	0.005724	0.005676
Estate Scale & L-shape	-	-	-	-	0.000006	0.000006
Age & Rectangular-shape	-	-	-	-	0.004228	0.003971
Gross Size & Rectangular-shape	-	-	-	-	0.000133	0.000125
Net Ratio & Rectangular-shape	-	-	-	-	0.636344	0.598008
Distance from CBD & Rectangular-shape	-	-	-	-	0.006504	0.006352
Estate Scale & Rectangular-shape	-	-	-	-	0.000005	0.000005
*"Two-rectangle" is controlled						

Table 4f Estimated results from several models (Maximum of estimated coefficients)

No. of period = 56	Maximum value of Estimated Coefficients					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	-0.416007	-0.646943	-0.610821	-0.610821	-1.090430	-1.090430
Age	0.084530	0.023266	0.025354	0.022100	0.032131	0.032965
Age2	-0.000331	0.000567	0.000463	0.000463	0.000259	0.000241
Floor	0.015655	0.014698	0.015826	0.011866	0.015285	0.011966
Floor2	-0.000095	-0.000111	-0.000121	-0.000104	-0.000102	-0.000085
Gross size	0.003306	0.002920	0.003024	0.003056	0.003301	0.003058
Gross size2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Net ratio	-	1.597843	1.541430	1.541430	4.132405	3.171738
Clubhouse	0.146469	0.148846	0.132177	0.132177	0.124099	0.124099
Lucky Number	0.057452	0.056349	0.056280	0.060719	0.064790	0.067149
MTR500	0.123524	0.166949	0.175575	0.176556	0.205801	0.205801
KCR500	0.519318	0.278119	0.303269	0.310340	0.297830	0.325898
Open Space 500	0.075511	0.183355	0.181194	0.189596	0.187530	0.200154
Water 500	0.243443	0.022211	0.048045	0.032447	0.001225	0.017734
Distance from CBD	-	-0.004710	-0.006561	-0.006561	-0.003265	-0.003265
Distance from CBD2	-	0.000497	0.000515	0.000307	0.000727	0.000504
Hong Kong Island	0.556253	0.377142	0.365091	0.336039	0.356624	0.312852
Kowloon	0.460102	0.184688	0.164847	0.152023	0.097078	0.085290
Estate Scale	-	0.000014	0.000013	0.000013	0.000014	0.000014
Foyer	-	-	0.013739	0.013739	0.025196	0.025196
Corridor	-	-	0.059495	0.046549	0.040472	0.027248
Balcony	-	-	0.083692	0.088634	0.101507	0.101507
No. of bedrooms	-	-	0.037037	0.038795	0.022360	0.025308
No. of toilet	-	-	0.019888	-0.006889	0.042640	0.009483
Kitchen accessible to living room	-	-	0.045172	0.044929	0.041275	0.038118
Kitchen adjacent to bedrooms	-	-	0.027942	0.014316	0.003472	0.003404
Toilet adjacent to bedrooms	-	-	0.124403	0.123411	0.098585	0.096085
Diamond*	-	-	0.073622	0.086936	2.828506	2.759486
L-shape*	-	-	0.077527	0.076354	2.947213	2.616730
Rectangular*	-	-	0.057184	0.059786	2.414547	2.168976
Store room	-	-	0.057794	0.048848	0.060657	0.053615
Roof	-	-	0.132346	0.112245	0.091733	0.091733
Deck	-	-	0.248141	0.242418	0.262623	0.266011
Sea-view	-	0.160960	0.153865	0.149774	0.178148	0.173512
Age & Diamond	-	-	-	-	0.018356	0.016379
Gross Size & Diamond	-	-	-	-	0.000206	0.000278
Net Ratio & Diamond	-	-	-	-	0.161982	0.000571
Distance from CBD & Diamond	-	-	-	-	0.002558	0.002558
Estate Scale & Diamond	-	-	-	-	0.000032	0.000033
Age & L-shape	-	-	-	-	0.006602	0.006730
Gross Size & L-shape	-	-	-	-	0.000305	0.000214
Net Ratio & L-shape	-	-	-	-	-0.017669	-0.017669
Distance from CBD & L-shape	-	-	-	-	0.006278	0.004930
Estate Scale & L-shape	-	-	-	-	0.000029	0.000025
Age & Rectangular-shape	-	-	-	-	0.013539	0.014498
Gross Size & Rectangular-shape	-	-	-	-	0.000308	0.000308
Net Ratio & Rectangular-shape	-	-	-	-	0.173185	0.381843
Distance from CBD & Rectangular-shape	-	-	-	-	0.011251	0.009553
Estate Scale & Rectangular-shape	-	-	-	-	0.000025	0.000014
*"Two-rectangle" is controlled						

Table 4g Estimated results from several models (Minimum of estimated coefficients)

No. of period = 56	Minimum value of Estimated Coefficients					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	-2.175386	-2.228592	-2.271716	-2.317266	-3.438148	-3.514871
Age	0.003347	-0.034563	-0.034104	-0.034104	-0.038910	-0.027507
Age2	-0.002220	-0.000815	-0.000881	-0.000881	-0.001334	-0.001334
Floor	0.005349	0.006064	0.006855	0.006318	0.006541	0.006029
Floor2	-0.000443	-0.000396	-0.000434	-0.000267	-0.000397	-0.000250
Gross size	0.002176	0.001633	0.001740	0.001765	0.001395	0.001483
Gross size2	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001
Net ratio	-	0.380178	0.322989	0.559919	0.902162	1.047403
Clubhouse	-0.050799	-0.003393	-0.008080	-0.006611	-0.028721	-0.025602
Lucky Number	-0.041100	-0.036385	-0.036236	-0.027459	-0.037956	-0.030364
MTR500	-0.052614	0.026577	0.024026	0.024026	0.016554	0.016554
KCR500	0.087982	-0.036932	-0.003872	-0.010227	-0.070060	-0.075974
Open Space 500	-0.124960	0.006332	0.000785	0.000941	-0.002744	-0.001921
Water 500	0.048925	-0.123634	-0.125124	-0.127716	-0.197471	-0.196226
Distance from CBD	-	-0.035479	-0.032637	-0.030382	-0.038268	-0.037510
Distance from CBD2	-	-0.000498	-0.000466	-0.000466	-0.000213	-0.000213
Hong Kong Island	0.203616	0.029944	0.042737	0.042737	0.047796	0.047796
Kowloon	0.159388	-0.058153	-0.040300	-0.023804	-0.090696	-0.094031
Estate Scale	-	-0.000006	-0.000007	-0.000003	-0.000013	-0.000010
Foyer	-	-	-0.080243	-0.081160	-0.069550	-0.074229
Corridor	-	-	-0.032947	-0.032146	-0.045707	-0.045690
Balcony	-	-	-0.101107	-0.112514	-0.125986	-0.123727
No. of bedrooms	-	-	-0.080308	-0.058327	-0.101103	-0.063342
No. of toilet	-	-	-0.063655	-0.073282	-0.064976	-0.077230
Kitchen accessible to living room	-	-	-0.048186	-0.053443	-0.052432	-0.061959
Kitchen adjacent to bedrooms	-	-	-0.098075	-0.099534	-0.130531	-0.129695
Toilet adjacent to bedrooms	-	-	-0.098414	-0.086398	-0.109879	-0.099615
Diamond*	-	-	-0.062928	-0.071992	0.164294	0.287086
L-shape*	-	-	-0.066322	-0.081245	0.156892	0.156892
Rectangular*	-	-	-0.034155	-0.055853	-0.201896	-0.467159
Store room	-	-	-0.071205	-0.048908	-0.088784	-0.059995
Roof	-	-	-0.013040	-0.018678	-0.043747	-0.022013
Deck	-	-	-0.062159	-0.071127	-0.043646	-0.056046
Sea-view	-	0.003124	0.010290	0.010290	0.036396	0.036396
Age & Diamond	-	-	-	-	-0.019527	-0.019527
Gross Size & Diamond	-	-	-	-	-0.000456	-0.000401
Net Ratio & Diamond	-	-	-	-	-3.216853	-2.994903
Distance from CBD & Diamond	-	-	-	-	-0.033081	-0.032002
Estate Scale & Diamond	-	-	-	-	-0.000021	-0.000011
Age & L-shape	-	-	-	-	-0.011380	-0.015158
Gross Size & L-shape	-	-	-	-	-0.000430	-0.000545
Net Ratio & L-shape	-	-	-	-	-3.587660	-2.870180
Distance from CBD & L-shape	-	-	-	-	-0.021058	-0.021596
Estate Scale & L-shape	-	-	-	-	-0.000008	-0.000008
Age & Rectangular-shape	-	-	-	-	-0.005486	-0.005518
Gross Size & Rectangular-shape	-	-	-	-	-0.000298	-0.000354
Net Ratio & Rectangular-shape	-	-	-	-	-2.995766	-2.697636
Distance from CBD & Rectangular-shape	-	-	-	-	-0.020528	-0.020396
Estate Scale & Rectangular-shape	-	-	-	-	-0.000008	-0.000007
*"Two-rectangle" is controlled						

Table 4h Estimated results from several models (Positively significant, Robustness Check for Heteroskedasticity)

No. of period = 56	Positive Significant at 0.05 Level					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Age	***96.43%***	3.57%	7.14%	12.50%	3.57%	3.57%
Age2	0.00%	7.14%	5.36%	5.36%	0.00%	0.00%
Floor	***100.00%***	***100.00%***	***100.00%***	***100.00%***	**100.00%**	***100.00%***
Floor2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross size	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Gross size2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Net ratio	-	***100.00%***	***98.21%***	***100.00%***	***100.00%***	***100.00%***
Clubhouse	***73.21%***	***85.71%***	***80.36%***	***83.93%***	***73.21%***	***75.00%***
Lucky Number	10.71%	19.64%	26.79%	23.21%	28.57%	26.79%
MTR500	***46.43%***	***100.00%***	***100.00%***	***100.00%***	***98.21%***	***98.21%***
KCR500	***98.21%***	***92.86%***	***94.64%***	***96.43%***	***91.07%***	***91.07%***
Open Space 500	10.71%	***94.64%***	***91.07%***	***94.64%***	***82.14%***	***85.71%***
Water 500	***100.00%***	0.00%	0.00%	0.00%	0.00%	0.00%
Distance from CBD	-	0.00%	0.00%	0.00%	0.00%	0.00%
Distance from CBD2	-	33.93%	28.57%	28.57%	***60.71%***	***62.50%***
Hong Kong Island	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Kowloon	***100.00%***	***80.36%***	***58.93%***	***66.07%***	12.50%	16.07%
Estate Scale	-	***83.93%***	***66.07%***	***69.64%***	26.79%	26.79%
Foyer	-	-	1.79%	1.79%	0.00%	0.00%
Corridor	-	-	25.00%	25.00%	1.79%	1.79%
Balcony	-	-	5.36%	5.36%	19.64%	19.64%
No. of bedrooms	-	-	0.00%	1.79%	0.00%	0.00%
No. of toilet	-	-	0.00%	0.00%	0.00%	0.00%
Kitchen accessible to living room	-	-	8.93%	8.93%	23.21%	21.43%
Kitchen adjacent to bedrooms	-	-	0.00%	0.00%	0.00%	0.00%
Toilet adjacent to bedrooms	-	-	41.07%	41.07%	23.21%	23.21%
Diamond*	-	-	30.36%	32.14%	***91.07%***	***92.86%***
L-shape*	-	-	37.50%	37.50%	***87.50%***	***89.29%***
Rectangular*	-	-	7.14%	10.71%	***67.86%***	***69.64%***
Store room	-	-	3.57%	5.36%	5.36%	5.36%
Roof	-	-	***71.43%***	***69.64%***	***67.86%***	***67.86%***
Deck	-	-	***69.64%***	***71.43%***	***78.57%***	***76.79%***
Sea-view	-	***92.86%***	***91.07%***	***96.43%***	***96.43%***	***98.21%***
Age & Diamond	-	-	-	-	17.86%	16.07%
Gross Size & Diamond	-	-	-	-	0.00%	0.00%
Net Ratio & Diamond	-	-	-	-	0.00%	0.00%
Distance from CBD & Diamond	-	-	-	-	0.00%	0.00%
Estate Scale & Diamond	-	-	-	-	***62.50%***	***62.50%***
Age & L-shape	-	-	-	-	1.79%	1.79%
Gross Size & L-shape	-	-	-	-	3.57%	1.79%
Net Ratio & L-shape	-	-	-	-	0.00%	0.00%
Distance from CBD & L-shape	-	-	-	-	0.00%	0.00%
Estate Scale & L-shape	-	-	-	-	***51.79%***	***55.36%***
Age & Rectangular-shape	-	-	-	-	33.93%	35.71%
Gross Size & Rectangular-shape	-	-	-	-	17.86%	17.86%
Net Ratio & Rectangular-shape	-	-	-	-	0.00%	0.00%
Distance from CBD & Rectangular-shape	-	-	-	-	14.29%	14.29%
Estate Scale & Rectangular-shape	-	-	-	-	44.64%	46.43%
Mean R-square	0.8173	0.8673	0.8711	0.8941	0.8764	0.8993
Mean Adj. R-square	-	-	-	-	-	-

*"Two-rectangle" is controlled

Table 4i Estimated results from several models (Negatively significant, Robustness Check for Heteroskedasticity)

No. of period = 56	Negative Significant at 0.05 Level					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***	***100.00%***
Age	0.00%	***66.07%***	***55.36%***	***57.14%***	***48.21%***	***50.00%***
Age2	***100.00%***	***62.50%***	***67.86%***	***67.86%***	***67.86%***	***69.64%***
Floor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Floor2	***96.43%***	***96.43%***	***98.21%***	***98.21%***	***96.43%***	***98.21%***
Gross size	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross size2	***100.00%***	***98.21%***	***100.00%***	***100.00%***	***94.64%***	***100.00%***
Net ratio	-	0.00%	0.00%	0.00%	0.00%	0.00%
Clubhouse	3.57%	0.00%	0.00%	0.00%	0.00%	0.00%
Lucky Number	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
MTR500	16.07%	0.00%	0.00%	0.00%	0.00%	0.00%
KCR500	0.00%	0.00%	0.00%	0.00%	1.79%	1.79%
Open Space 500	***75.00%***	0.00%	0.00%	0.00%	0.00%	0.00%
Water 500	0.00%	***80.36%***	***71.43%***	***69.64%***	***75.00%***	***78.57%***
Distance from CBD	-	***100.00%***	***100.00%***	***100.00%***	***96.43%***	***94.64%***
Distance from CBD2	-	19.64%	17.86%	17.86%	7.14%	7.14%
Hong Kong Island	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kowloon	0.00%	1.79%	0.00%	0.00%	23.21%	25.00%
Estate Scale	-	0.00%	0.00%	0.00%	0.00%	0.00%
Foyer	-	-	35.71%	35.71%	8.93%	10.71%
Corridor	-	-	3.57%	7.14%	30.36%	33.93%
Balcony	-	-	41.07%	46.43%	***48.21%***	***51.79%***
No. of bedrooms	-	-	35.71%	35.71%	39.29%	41.07%
No. of toilet	-	-	***87.50%***	***83.93%***	***75.00%***	***78.57%***
Kitchen accessible to living room	-	-	7.14%	8.93%	1.79%	3.57%
Kitchen adjacent to bedrooms	-	-	37.50%	39.29%	***60.71%***	***60.71%***
Toilet adjacent to bedrooms	-	-	3.57%	3.57%	10.71%	8.93%
Diamond*	-	-	7.14%	8.93%	0.00%	0.00%
L-shape*	-	-	8.93%	10.71%	0.00%	0.00%
Rectangular*	-	-	14.29%	14.29%	0.00%	0.00%
Store room	-	-	33.93%	33.93%	33.93%	33.93%
Roof	-	-	0.00%	0.00%	0.00%	0.00%
Deck	-	-	0.00%	0.00%	0.00%	0.00%
Sea-view	-	0.00%	0.00%	0.00%	0.00%	0.00%
Age & Diamond	-	-	-	-	25.00%	25.00%
Gross Size & Diamond	-	-	-	-	***51.79%***	***53.57%***
Net Ratio & Diamond	-	-	-	-	***85.71%***	***87.50%***
Distance from CBD & Diamond	-	-	-	-	***94.64%***	***94.64%***
Estate Scale & Diamond	-	-	-	-	3.57%	3.57%
Age & L-shape	-	-	-	-	28.57%	33.93%
Gross Size & L-shape	-	-	-	-	10.71%	8.93%
Net Ratio & L-shape	-	-	-	-	***83.93%***	***85.71%***
Distance from CBD & L-shape	-	-	-	-	***75.00%***	***76.79%***
Estate Scale & L-shape	-	-	-	-	0.00%	0.00%
Age & Rectangular-shape	-	-	-	-	0.00%	0.00%
Gross Size & Rectangular-shape	-	-	-	-	3.57%	5.36%
Net Ratio & Rectangular-shape	-	-	-	-	***78.57%***	***78.57%***
Distance from CBD & Rectangular-shape	-	-	-	-	28.57%	32.14%
Estate Scale & Rectangular-shape	-	-	-	-	0.00%	0.00%

*"Two-rectangle" is controlled

Table 4j Estimated results from several models (Insignificant, Robustness Check for Heteroskedasticity)

No. of period = 56	Insignificant					
Implicit Prices	Basic Model 1	Basic Model 2	Model with "Design Variables"	Model using restricted sample	Model with "interactive terms and design"	Model with "interactive terms and design" using restricted sample
Constant	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Age	3.57%	30.36%	37.50%	30.36%	***48.21%***	46.43%
Age2	0.00%	30.36%	26.79%	26.79%	32.14%	30.36%
Floor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Floor2	3.57%	3.57%	1.79%	1.79%	3.57%	1.79%
Gross size	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross size2	0.00%	1.79%	0.00%	0.00%	5.36%	0.00%
Net ratio	-	0.00%	1.79%	0.00%	0.00%	0.00%
Clubhouse	23.21%	14.29%	19.64%	16.07%	26.79%	25.00%
Lucky Number	***89.29%***	***80.36%***	***73.21%***	***76.79%***	***71.43%***	***73.21%***
MTR500	37.50%	0.00%	0.00%	0.00%	1.79%	1.79%
KCR500	1.79%	7.14%	5.36%	3.57%	7.14%	7.14%
Open Space 500	14.29%	5.36%	8.93%	5.36%	17.86%	14.29%
Water 500	0.00%	19.64%	28.57%	30.36%	25.00%	21.43%
Distance from CBD	-	0.00%	0.00%	0.00%	3.57%	5.36%
Distance from CBD2	-	***46.43%***	***53.57%***	***53.57%***	32.14%	30.36%
Hong Kong Island	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kowloon	0.00%	17.86%	41.07%	33.93%	***64.29%***	***58.93%***
Estate Scale	-	16.07%	33.93%	30.36%	***73.21%***	***73.21%***
Foyer	-	-	***62.50%***	***62.50%***	***91.07%***	***89.29%***
Corridor	-	-	***71.43%***	***67.86%***	***67.86%***	***64.29%***
Balcony	-	-	***53.57%***	***48.21%***	32.14%	28.57%
No. of bedrooms	-	-	***64.29%***	***62.50%***	***60.71%***	***58.93%***
No. of toilet	-	-	12.50%	16.07%	25.00%	21.43%
Kitchen accessible to living room	-	-	***83.93%***	***82.14%***	***75.00%***	***75.00%***
Kitchen adjacent to bedrooms	-	-	***62.50%***	***60.71%***	39.29%	39.29%
Toilet adjacent to bedrooms	-	-	***55.36%***	***55.36%***	***66.07%***	***67.86%***
Diamond*	-	-	***62.50%***	***58.93%***	8.93%	7.14%
L-shape*	-	-	***53.57%***	***51.79%***	12.50%	10.71%
Rectangular*	-	-	***78.57%***	***75.00%***	32.14%	30.36%
Store room	-	-	***62.50%***	***60.71%***	60.71%	***60.71%***
Roof	-	-	28.57%	30.36%	32.14%	32.14%
Deck	-	-	30.36%	28.57%	21.43%	23.21%
Sea-view	-	7.14%	8.93%	3.57%	3.57%	1.79%
Age & Diamond	-	-	-	-	***57.14%***	***58.93%***
Gross Size & Diamond	-	-	-	-	48.21%	46.43%
Net Ratio & Diamond	-	-	-	-	14.29%	12.50%
Distance from CBD & Diamond	-	-	-	-	5.36%	5.36%
Estate Scale & Diamond	-	-	-	-	33.93%	33.93%
Age & L-shape	-	-	-	-	***69.64%***	***64.29%***
Gross Size & L-shape	-	-	-	-	***85.71%***	***89.29%***
Net Ratio & L-shape	-	-	-	-	16.07%	14.29%
Distance from CBD & L-shape	-	-	-	-	25.00%	23.21%
Estate Scale & L-shape	-	-	-	-	48.21%	44.64%
Age & Rectangular-shape	-	-	-	-	***66.07%***	***64.29%***
Gross Size & Rectangular-shape	-	-	-	-	***78.57%***	***76.79%***
Net Ratio & Rectangular-shape	-	-	-	-	21.43%	21.43%
Distance from CBD & Rectangular-shape	-	-	-	-	***57.14%***	***53.57%***
Estate Scale & Rectangular-shape	-	-	-	-	***55.36%***	***53.57%***

*"Two-rectangle" is controlled

Table 5 Interactive terms

Variables	"Diamond" related interactive terms	"L-shape" related interactive terms	"Rectangular" related interactive terms	"Tw o-Rectangle" related interactive terms
Age	Age & Diamond	Age & L-shape	Age & Rectangular	Age & Tw o-Rectangle
Gross size	Gross size & Diamond	Gross size & L-shape	Gross size & Rectangular	Gross size & Tw o-Rectangle
Net ratio	Net ratio & Diamond	Net ratio & L-shape	Net ratio & Rectangular	Net ratio & Tw o-Rectangle
Distance from CBD	Distance from CBD & Diamond	Distance from CBD & L-shape	Distance from CBD & Rectangular	Distance from CBD & Tw o-Rectangle
Estate scale	Estate scale & Diamond	Estate scale & L-shape	Estate scale & Rectangular	Estate scale & Tw o-Rectangle

Appendix Two

Figures

Figure 1 Implicit prices of "Age" in Basic Model 1 and Basic Model 2

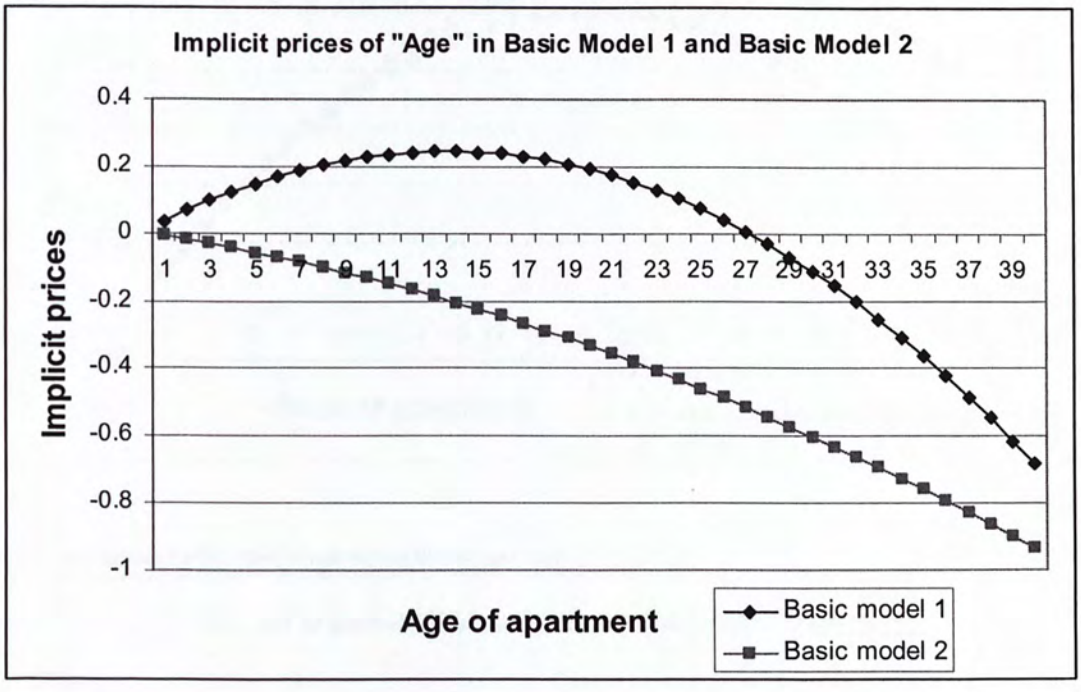


Figure 2 Implicit prices of "Age" in different models

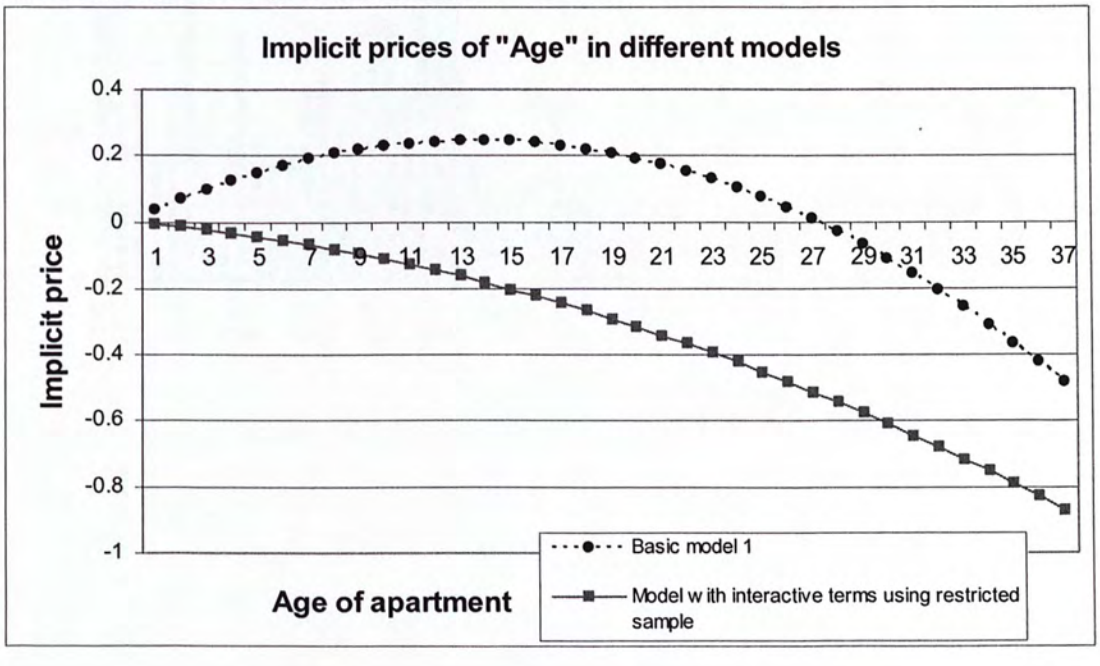


Figure 3 Implicit prices of "Floor" in different models

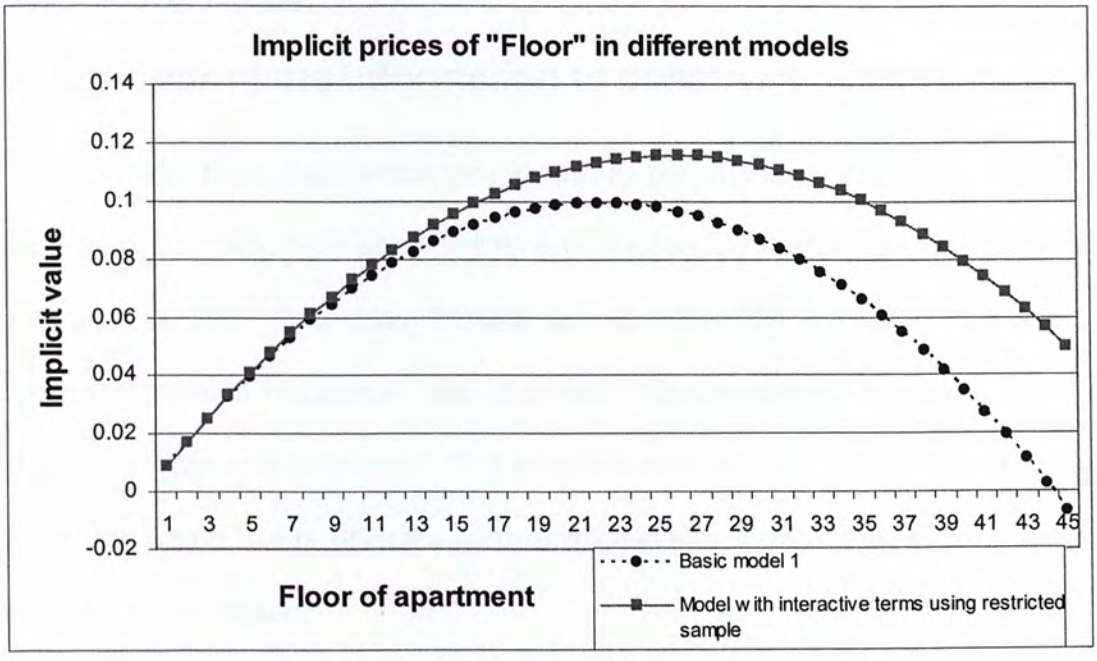
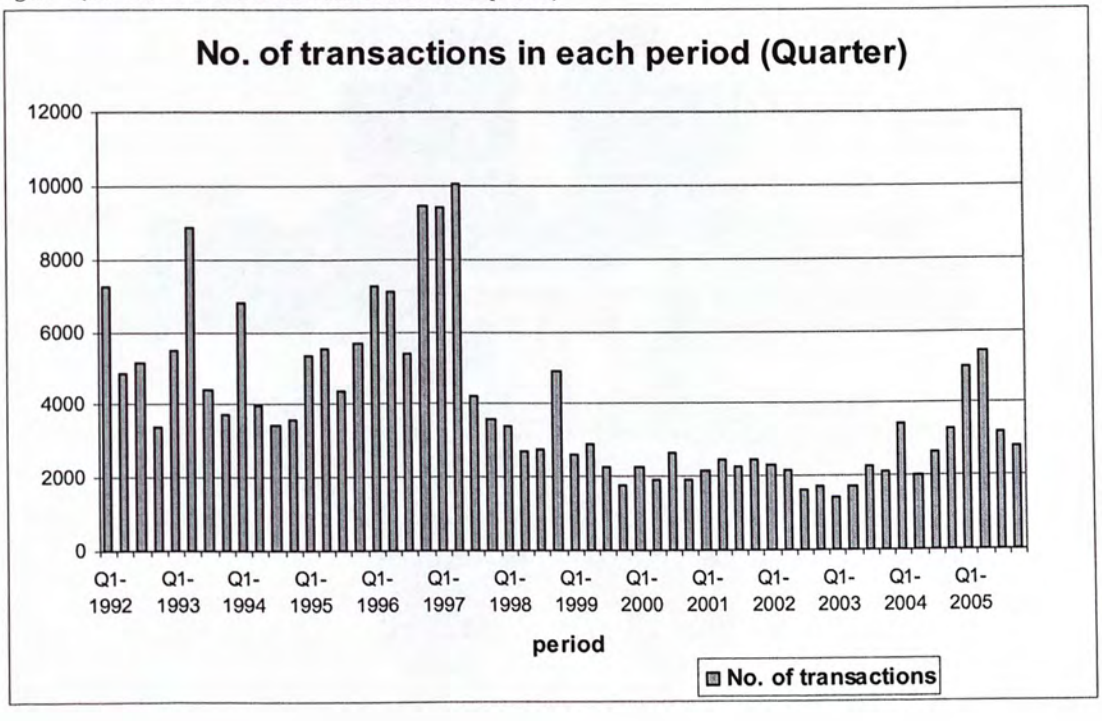


Figure 4 (Bar chart of number of transaction in each quarter)



Appendix Three

Using floor plans information to construct dataset

We use floor plans, which are provided by property agency firms, to complete the dataset. Actually, floor plans contain lots of information which is very useful for our analysis. The floor plan features are as followings: "Foyer", "Corridor", "Balcony", "No. of bedrooms", "No. of toilets", "Kitchen accessible to living room", "Kitchen adjacent to bedrooms", "Toilet adjacent to bedroom" and shape of living room. We would like to illustrate (with examples) how to record the interior design variables of our dataset.

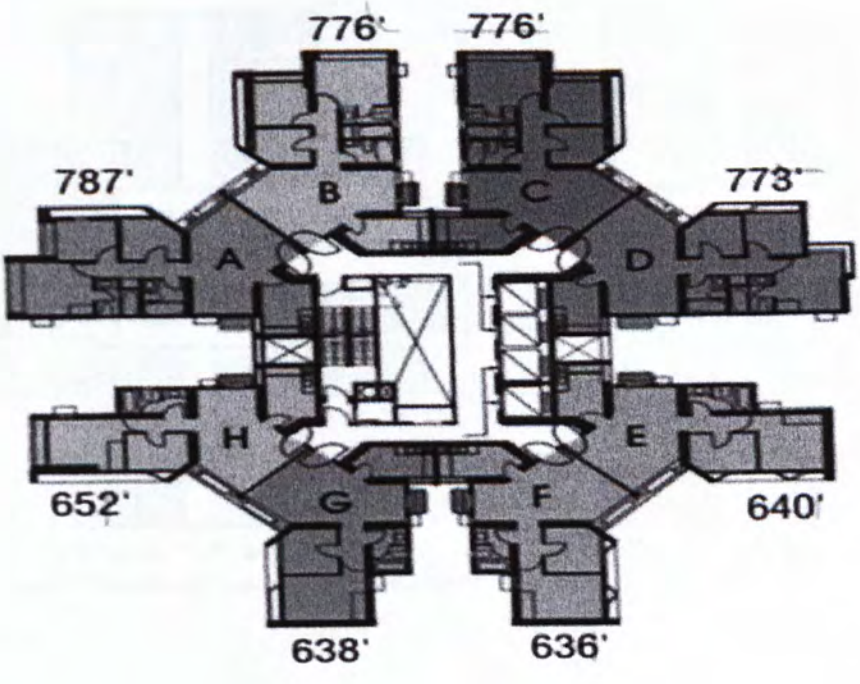


Figure for example 1 (Floor plan of "Diamond-shape" living room)[40], South Horizons

[40] Source from Midland Holding's website :
http://www.midland.com.hk/agency/chi/residential/developer_project/E00021/fp01.jpg

Example 1

All flats in figure 1 belong to "Diamond-shape" living room category. In Flat A, There are three bedrooms, and two toilets. Kitchen is accessible to living room, therefore, the dummy variable ""Kitchen accessible to living room" is one; Toilet is located next to bedrooms, therefore, the dummy variable "Toilet adjacent to bedroom" is one; The kitchen isn't located near bedroom, therefore, the dummy variable "Kitchen adjacent to bedroom" is zero. There exists a corridor, whereas there is no foyer and balcony, thus, the dummy variable "Corridor" is one, on the other hand, the dummy variable "Foyer" and "Balcony" is zero.

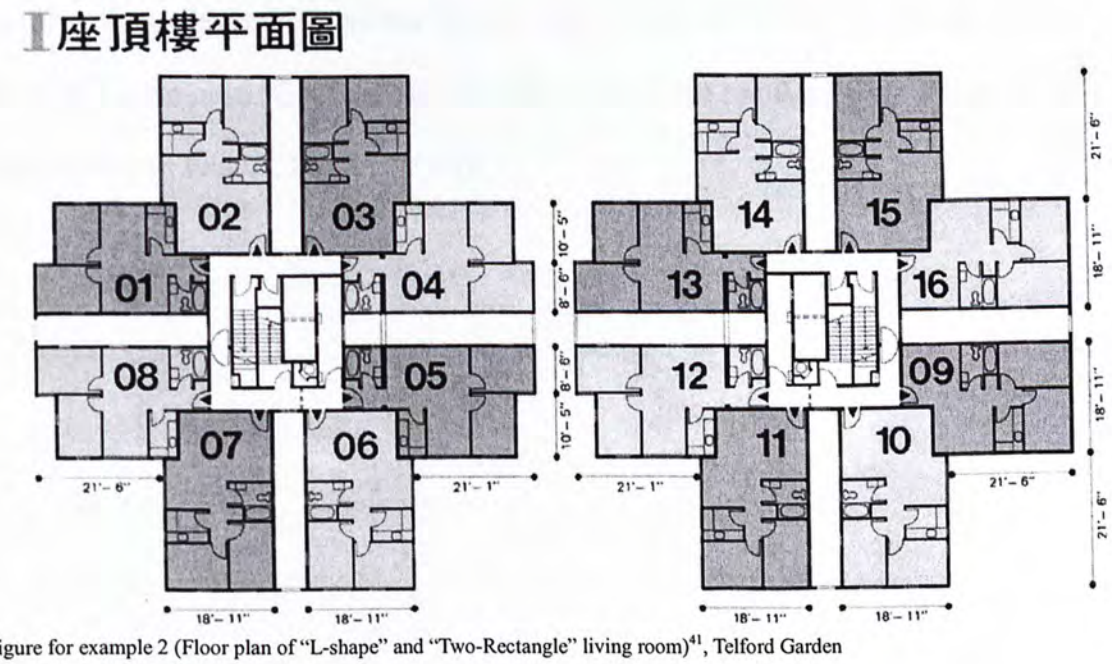


Figure for example 2 (Floor plan of "L-shape" and "Two-Rectangle" living room)[41], Telford Garden

Example 2

Flat 01 belongs to "L-shape" living room category. There are two bedrooms and one toilet. Kitchen is accessible to living room, therefore, the dummy variable ""Kitchen accessible to living room" is one; neither toilet nor kitchen isn't located next to

[41] Flat 02 belongs to "Two-Rectangle" type, whereas, Flat 04 belongs to "L-shape" type.
Source from Midland Holding's
website :http://www.midland.com.hk/agency/chi/residential/developer_project/E00056/i_1.jpg

bedrooms, therefore, the dummy variable "Toilet adjacent to bedroom" and "Kitchen adjacent to bedroom" is zero. There is no corridor and balcony, whereas there is a foyer, thus, the dummy variable "Corridor" and "Balcony" is zero, on the other hand, the dummy variable "Foyer" is one. We can see that the floor plan of Flat 01 is same as that of Flat 04, 05, 08, 12, and13.

Flat 02 belongs to "Two-rectangle" living room category. There are two bedrooms and one toilet. Kitchen is accessible to living room, therefore, the dummy variable "Kitchen accessible to living room" is one; both toilet and kitchen are located next to bedroom, therefore, the dummy variable "Toilet adjacent to bedroom" and "Kitchen adjacent to bedroom" is one. There is no foyer and balcony, whereas there is a corridor, thus, the dummy variable "Foyer" and "Balcony" is zero, on the other hand, the dummy variable "Corridor" is one. We can see that the floor plan of Flat 02 is same as that of Flat 03, 06, 07, 10 to16.

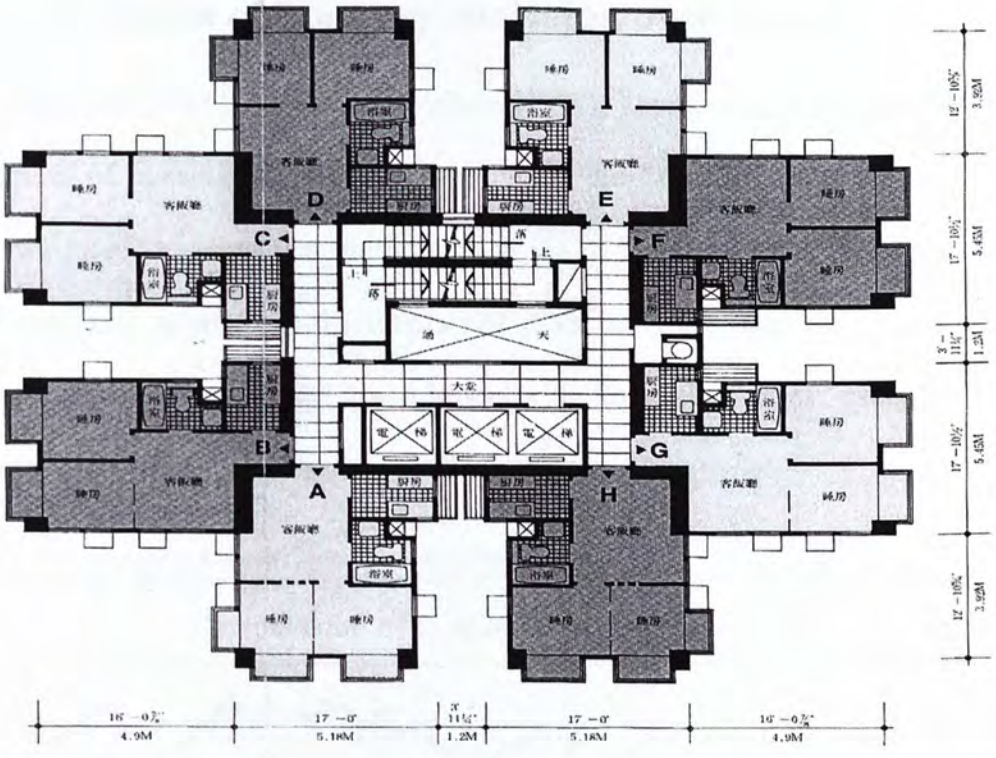


Figure for example 3 (Floor plan of "Rectangular" shape living room)[42], Tai Po Center

Example 3

All flats shown in figure 3 belong to "Rectangular" shape living room category. The floor plans of Flat A, D, E and H are the same, whereas the floor plan of Flat B, C, F and G are the same. There are two bedrooms and one toilet in all flats. There is a "Foyer" and kitchen is accessible to living room, therefore, the dummy variable ""Kitchen accessible to living room" is one in Flat B, C, F and G; on the other hand, Flat A, D, E and H don't have a foyer. All of eight flats do not have a corridor and balcony, and the toilet or kitchen isn't located next to bedrooms, thus, the dummy variables "Corridor", "Balcony", "Toilet adjacent to bedroom" and "Kitchen adjacent to bedroom" is zero.

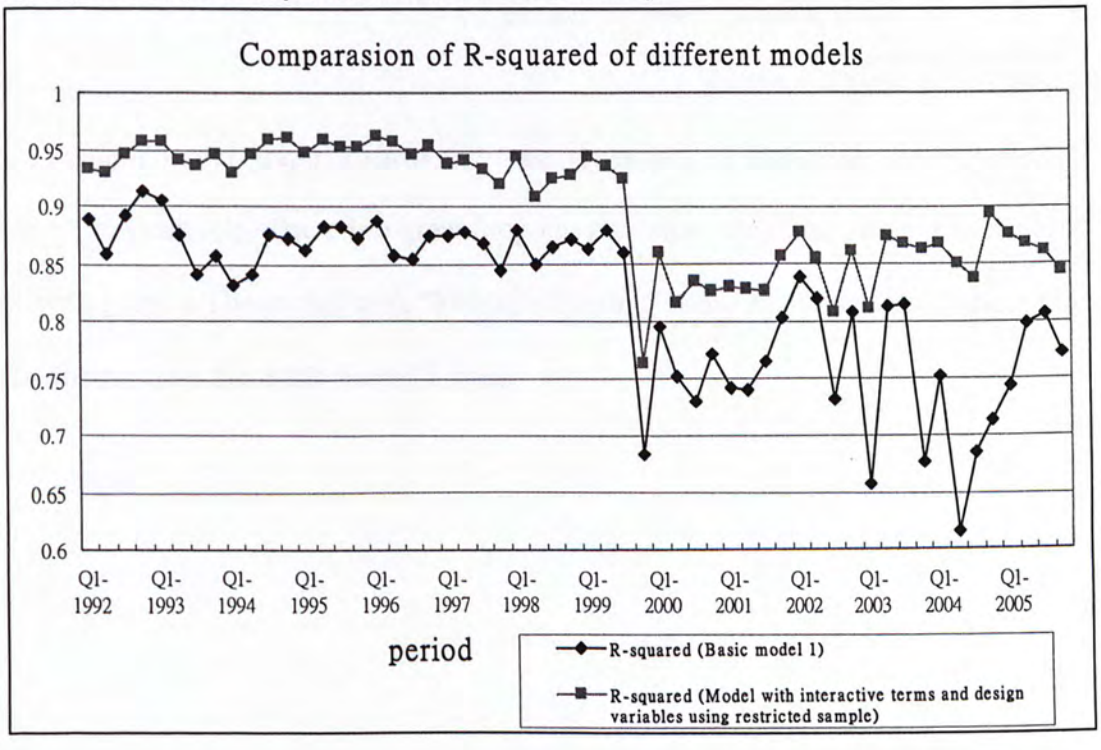
[42] All flats shown in figure 3 belong to "Rectangular" shape living room. Source from Midland Holdings' website:
http://www.midland.com.hk/agency/chi/residential/developer_project/E00072/fp_blk01.jpg

Appendix Four

Implicit prices of housing attributes over time

Edmonds (1985), Meese and Wallace (1997), Leung et al (2006) confirm that the prices of housing attributes, at equilibrium, are fluctuating over time.[43] In this part, we intend to show that the implicit prices of housing attributes are not stable over time and to compare the time series plots using the results of two different models, namely, Basic model 1 and Model with "Interactive terms" using restricted sample.

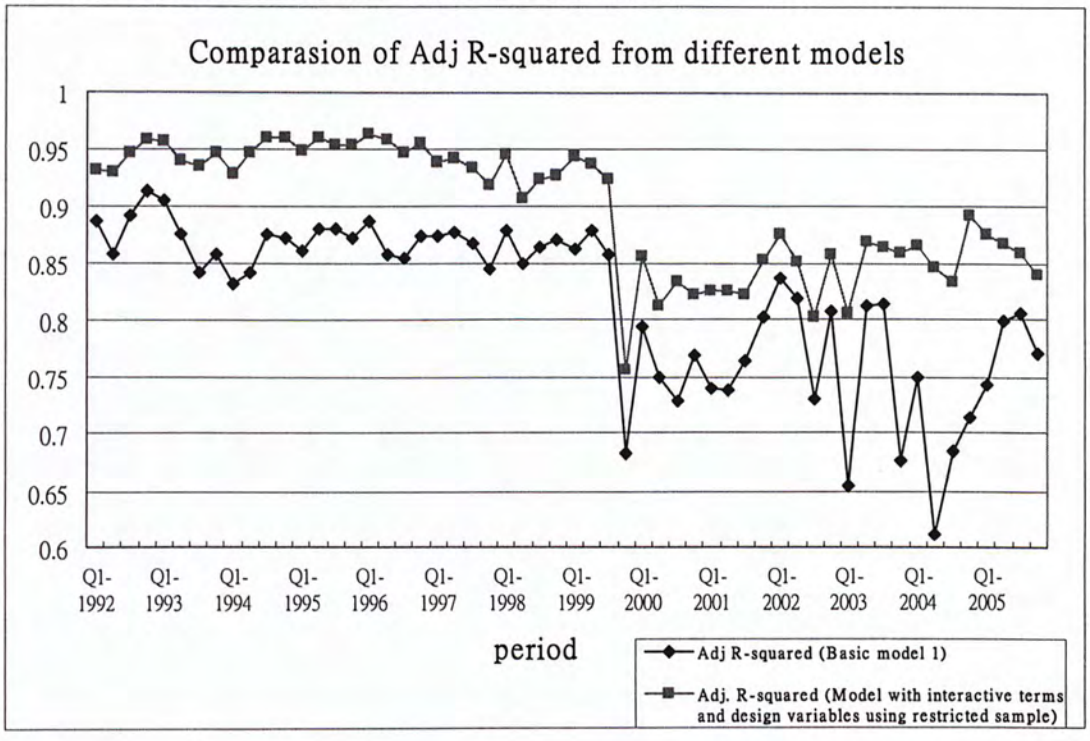
Graph 1 (Time series plot of R-square's coefficients from different models[44])



[43] For detail, See Leung (2007).

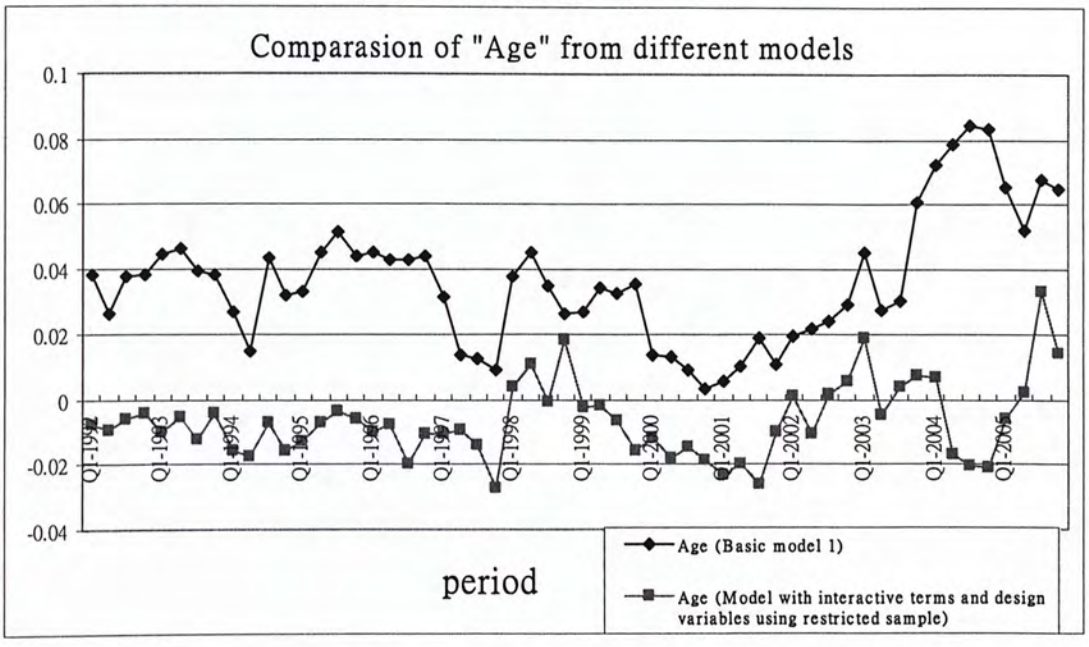
[44] Basic mode refers to the model shown in table 6.
Model with "Design variables" refers to model in table 10.

Graph 2 (Time series plot of Adj. R-square's coefficients from different models)



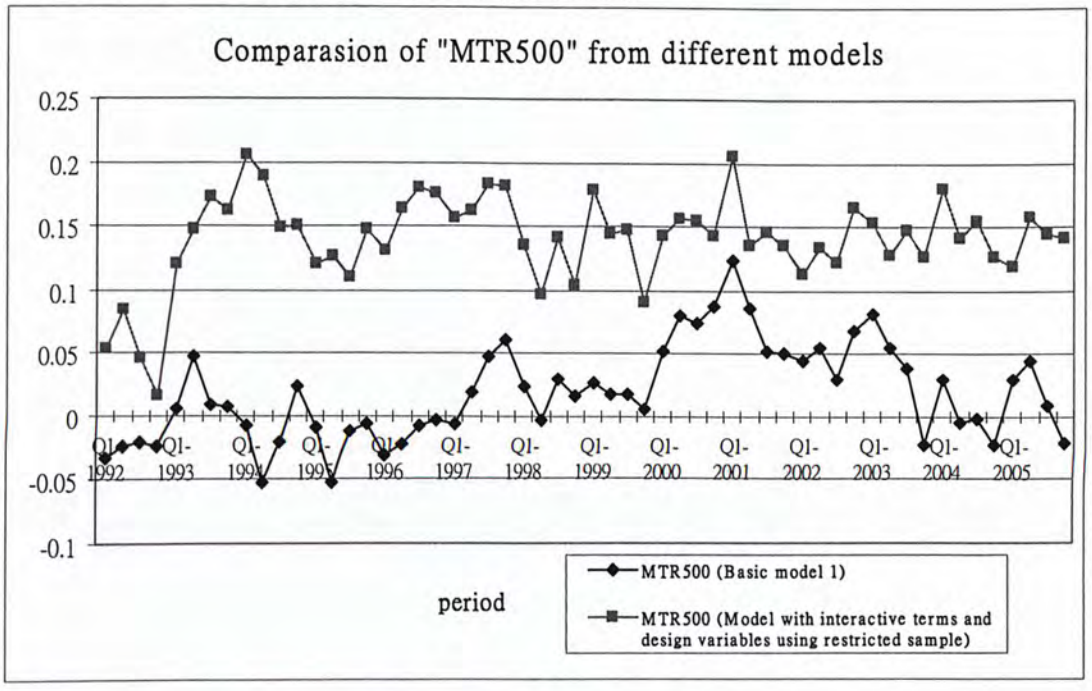
Graph 1 and graph 2 show the time series plot of R-square and Adjusted R-square respectively. There is a great drop in value since the third quarter of year 1999 in both graphs. The model with "Interactive terms" using restricted sample can fit the data better than the Basic model 1 does.

Graph 3 (Time series plot of Age's coefficients from different models)



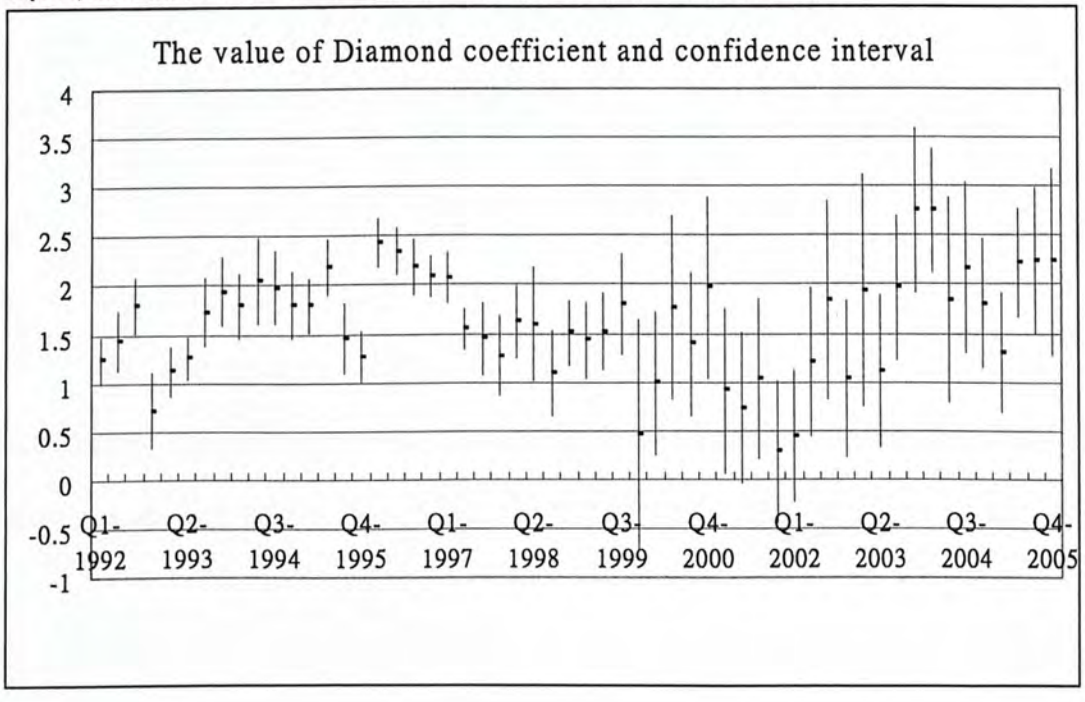
All of the implicit prices of "Age" from Basic model 1 are positive value, whereas almost all of these coming from the Model with "Interactive terms" using restricted sample are negative value. We suspect that there should be omitted variable bias in Basic model 1.

Graph 4 (Time series plot of MTR500's coefficients from different models)

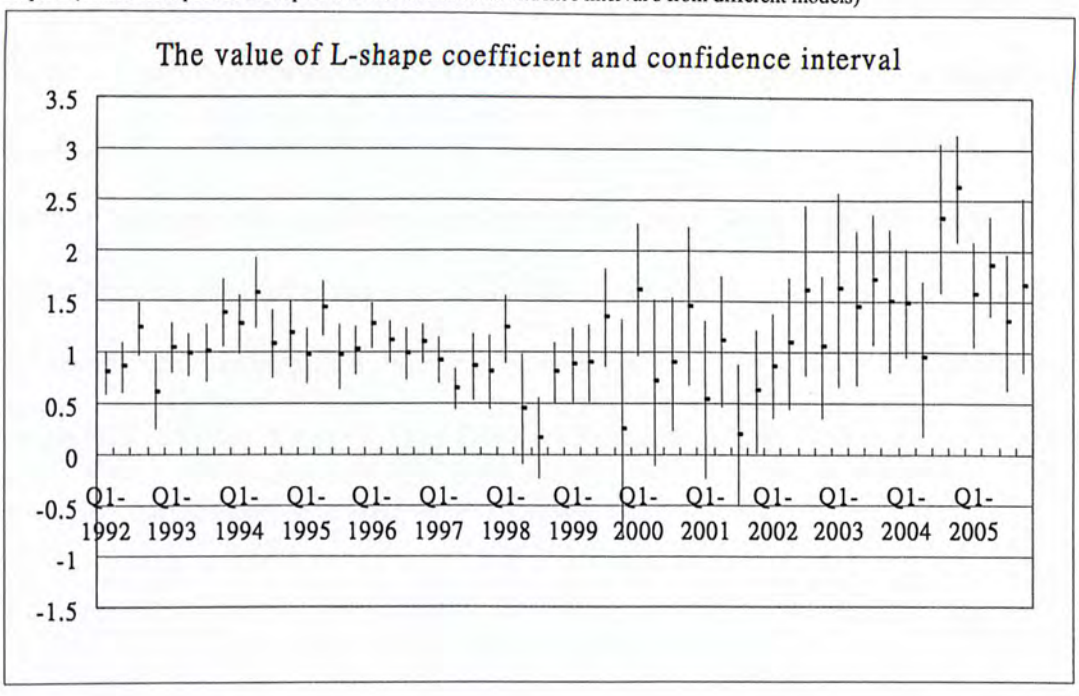


MTR is one of the major mass transportation systems in Hong Kong. It is generally believed that residential estates located along MTR routes can have better resistance from fluctuation of economic performance. The implicit prices of "MTR 500" from the Model with "Interactive terms" using restricted sample are quite stable over time and consistently to have positive value during that time horizon.

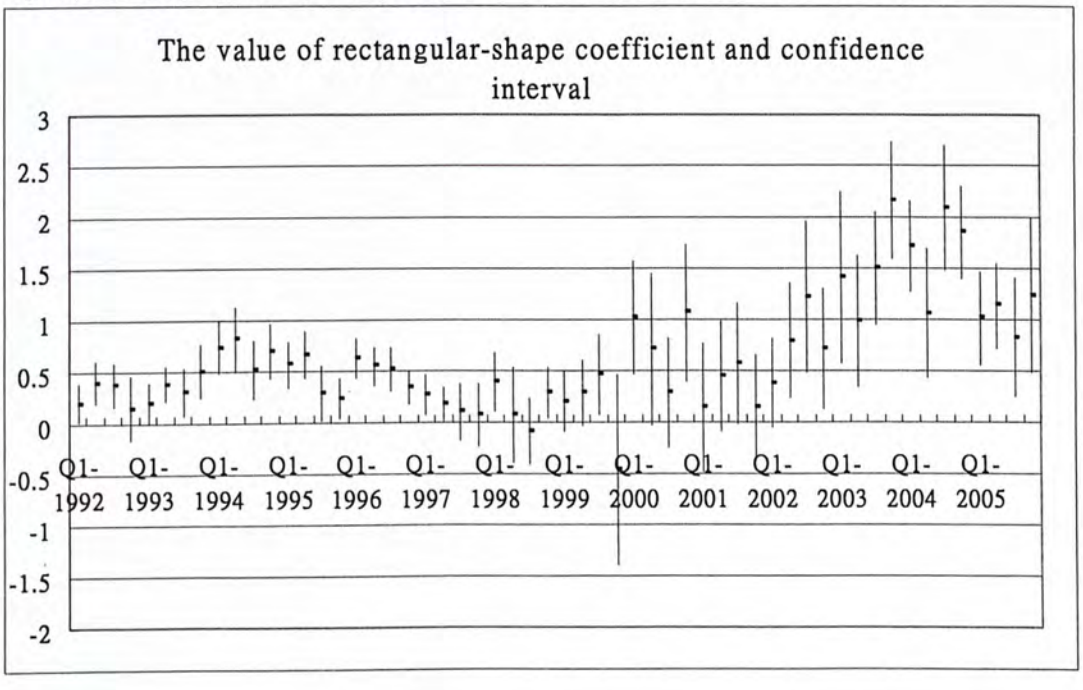
Graph 5 (Time series plot of Diamond's coefficient and its confidence interval s from different models)



Graph 6 (Time series plot of L-shape's coefficient and its confidence interval s from different models)



Graph 7 (Time series plot of Rectangular-shape's coefficient and its confidence interval s from different models)



We also analyze whether the "Design variables" change over time or existence of time trend. We use the value of Living room's estimated coefficient in each quarter and its confidence interval from "Model with interactive terms and

design variable using restricted sample".[45] We observe that there is an obvious trend which is coincidence with the general economic performance and there is an increase in range of confidence interval after the third quarter of year 1999. For example, there is a downtrend after the second quarter of year 1997, when the burst of real estate bubble. And after the second quarter of year 2003, we can observe that an uptrend is constructing. It is because these living room shapes are preferred to the controlled variable; therefore, they should be superior goods. When the economy is booming, participants in residential market will price them higher, vice versa.

[45] Living room variables are "Diamond", "L-shape" and "Rectangular-shape"; "Two-Rectangle shape" is controlled.

Appendix Five

Robustness check for the potential problem of heteroskedasticity

Heteroskedasticity refers to regression disturbances whose variances are not constant across observations. [46] In empirical works of real estate analysis, Heteroskedasticity may also arise in many circumstances, for instance, we may group the observations from various classes of housing, and we may see greater variance for the high transaction price group than that for the low transaction price group. The difference in variance of transaction price might depend on building quality and reputation of the entire district. In this section, we compare the result from heteroskedasticity regression and that from OLS with various specification forms.

The results from Heteroskedasticity regression are more or less the same as those from OLS estimation.[47] Therefore, we may conclude that our contribution to real estate economics, which is the introduction of design variables in valuation of high rise residential housing, is still valid.

(Figure 4h, 4i and 4j about here)

[46] For details, see Greene W.,(2000) Econometrics Analysis, 4th ed, New Jersey: Prentice Hall

[47] In the sense that the directions of significance of variable are the same, however, the degree of significance is not unchanged. When we consider the potential problem of Heteroskedasticity, we can see that the importance of "Deck" rises notably in various specification forms.

Reference

Archer, W. R., Gatzlaff, D. H. and D. C. Ling (1996), "Measuring the Importance of Location in House Price Appreciation", *Journal of Urban Economics*, 40(3), 334 – 353

Asabere, Paul K., Hachey, George and Grubaugh, Steven (1989), "Architecture, historic zoning, and the value of homes", *The Journal of Real Estate Finance and Economics,* Volume 2, Number 3, pp 181-195.

Asabere, Paul K., and Huffman, Forrest E. (1993), "Price concessions, time on the market, and the actual sale price of homes", *The Journal of Real Estate Finance and Economics,* Volume 6, Number 2 / March, 1993, pp 167-174.

Ball, Vicoria Kloss (1982), The Art of Interior Design, 2nd ed., New York: John Wiley.

Beaton, W. P., Pollock, Marcus (1992), "Economic Impact of Growth Management Policies Surrounding the Chesapeake Bay" *Land Economics*, Vol. 68, No. 4, pp. 434-453

Benson Earl D., Hansen, Julia L., Schwartz, Arthur L., Jr. and Smersh, Greg T. (1998) "Pricing Residential Amenities: The Value of a View", *The Journal of Real Estate* Finance and Economics, Volume 16, Number 1 / January, 1998

Bowes, David R., and Ihlanfeldt, Keith R. (2001), "Identifying the Impacts of Rail Transit Stations on Residential Property Values," Journal of Urban Economics, Vol. 50, 1-25.

Can, A. and Megbolugbe, I. (1997), "Spatial Dependence and House Price Index Construction", *Journal of Real Estate Finance and Economics*, 14(1-2), 203 – 222

Christano, L., M. Eichenbaum and D. Marshall (1991), "The Permanent Income Hypothesis Revisited, *Econometrica*, 59, 397-424.

Coleman, C. ed. (2002), Interior Design: Handbook of Porfessional Practice, New York: McGraw-Hill.

Court, A. T. (1939) "Hedonic Price Indexes with Automotive Examples", *The Dynamics of Automobile Demand*. General Motors, New York.

Dehring, Carolyn and Dunse, Neil (2006), "Housing Density and the Effect of Proximity to Public Open Space in Aberdeen, Scotland" *Real Estate Economics*, Volume 34 Issue 4 Pages 553.

DiPasquale, Denise and William Wheaton (1996), Urban Economics and Real Estate Markets, New Jeresy: Prentice Hall.

Grass, R. G. (1992), "The Estimation of Residential Property Values around Transit Station Sites in Washington, D.C." *Journal of Economics and Finance*, Vol. 16, 139-146.

Greene W. (2000) "Econometrics Analysis", 4th ed, New Jersey: Prentice Hall

Hanushek, Eric and Kuzey Yilmaz (2007b), "Schools and location: Tiebout, Alonso and government policy," NBER Working paper 12960.

Haurin, D. (1988), "The Duration of Marketing Time on Residential Housing", *Journal of the American Real Estate and Urban Economics Association*, 16, 396-410.

Jefferis, Alan and David Madsen (2001), Architectural Drafting and Design, 4th ed., Albany: Delmar, Thomas Learning.

Kask, S. B., Maani, S. A. (1992), "Uncertainty, Information, and Hedonic Pricing" *Land Economics*, Vol. 68, No. 2 pp. 170-184

Leung, C. K. Y., Lau, G. C. K., Leong, Y. C. F. (2002), "Testing Alternative Theories of the Property Price-Trading Volume Correlation", *Journal of Real Estate Research*, 23:253-263.

Leung, C. K. Y., Leong, Y. C. F., Wong, S. K. (2006) "Housing Price Dispersion: An Empirical Investigation", *Journal of Real Estate Finance and Economics*, 32:357-385.

Leung, C. K. Y., Cheung P. W. Y. (2007) "Equilibrium Correlations of Asset Price and Return with nominal rigidity", *Working Paper*, Third Annual Conference, 2007, Asia-Pacific Economic Association.

Mahan, B. L., Polasky S., Adams R. M. (2000), "Valuing Urban Wetlands: A Property Price Approach", *Land Economics*, Vol. 76, No. 1, pp. 100-113

Malpezzi, S. (2003), "Hedonic pricing models: a selective and applied review." In: O'Sullivan, T., Gibb, K. (eds.), *Housing Economics and Public Policy*. Blackwell, Malder, MA.

Mingche, M., Li, H., Brown, James (1980), "Micro-Neighborhood Externalities and Hedonic Housing Prices" *Land Economics*, Vol. 56, No. 2, pp. 125-141

Mok, Henry M.K., Chan, Patrick P.K. and Cho, Yiu Sun (1995), "Hedonic Price Model for Private Properties in Hong Kong," *Journal of Real Estate Finance and Economics*, 10(1), 37-48

Mok, Henry M.K. (1995), "A Hedonic Approach to Pricing of Residential Properties in Hong Kong," *Hong Kong Journal of Business Management*, XIII, 1-15.

Nakata, Saya and Asami, Yasushi (2006) "Prediction of floor layouts of houses using data f houses newly supplied in Tokyo Metropolitan area," *working paper*, University of Tokyo.

Portnov, Boris A., Fleishman, Larissa and Odish, Yakov (2006) "Changes and Modifications in Residential Neighborhoods as a Factor of Housing Pricing: Jerusalem and Haifa as Case Studies", *Journal of Real Estate Literature*, vol. 14, No. 3, 347-380.

Ricardo, D (1817), "Principles of Political Economy and Taxation" London: John Murray, 1821. Third edition.

Rosen, S. (1974), "Hedonic prices and implicit markets: Product differentiation in pure competition," *Journal of Political Economy*, vol. 82, no. 1, pp. 35-55.

Smith, M. S.; Moorhouse, J. C. (1993), "Architecture and the Housing Market: Nineteenth Century Row Housing in Boston's South End," Journal of the Society of Architectural Historians, Jun., Vol. 52, No. 2, pp. 159-178

Strand, J., Vågnes, M. (2001), "The relationship between property values and railroad proximity: a study based on hedonic prices and real estate brokers' appraisals", *Transportation*, Vol. 28 pp.137-56.

Vandell, K. D. (1995), "Market Factors affecting Spatial Heterogeneity among Urban Neighborhoods", *Housing Policy Debate, Fannie Mae*, 1995, Vol. 6, Issue 1, pp103-139.